The Effect of Grit and Mindset on Professional Pilot Student Persistence

by

Robert Fowler, B.A., M.S.A.

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Dissertation Committee

Dr. Kevin Krahenbuhl, Chair

Dr. Jim Rost

Dr. Wendy Beckman

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ABSTRACT

Due to a shortage of qualified commercial pilots and the high attrition rate of collegiate professional pilot students, increasing the number of students who successfully complete training is critical for the future success of the commercial aviation industry. The purpose of this exploratory sequential mixed methods study was to determine if Middle Tennessee State University (MTSU) students who enroll and eventually graduate in the Aerospace Professional Pilot concentration and students who enroll in the Aerospace Professional Pilot concentration but subsequently switch to another Aerospace concentration differ in the noncognitive traits of grit and growth mindset. Grit is defined as passion and perseverance for long-term goals (Duckworth, 2016), and growth mindset is defined as the belief that intelligence is not fixed and can be improved with effort and time. If students who are high in grit and growth mindset are more likely to complete training, identifying students who are high in these noncognitive traits and providing courses to enhance these traits may help alleviate the current pilot shortage. In the first quantitative phase of this mixed methods study, Angela Duckworth's Grit-S Scale was used to measure grit (Duckworth & Quinn, 2009), and Carol Dweck's mindset survey was used to measure growth mindset (Dweck, 2016) in MTSU Aerospace students who initially enrolled in the Professional Pilot concentration. Descriptive and inferential statistics were generated to see if there was a difference in grit and growth mindset between students who enrolled and persisted in the MTSU Aerospace Professional Pilot concentration and those who subsequently switched. Then a purposeful sample of four volunteers from each group was randomly selected to participate in the second qualitative phase of this mixed methods study to explain and clarify the results of the first phase quantitative results. Open ended questions were asked to determine if there is a difference in the educational experiences between the two groups of students. The first

phase quantitative results found a significant difference in grit but no significant difference in growth mindset between the two groups. Answers to the open-ended questions in the qualitative second phase demonstrated that the group who enrolled and stayed in the Professional Pilot concentration were more self-motivated than students who enrolled in the Professional Pilot concentration but subsequently switched to another Aerospace concentration.

CHAPTER I: INTRODUCTION

Before they can graduate and take their places on the flight decks of commercial airliners, students enrolled in collegiate professional pilot programs must face many challenges that most undergraduate students will never encounter. Earning a college degree in any discipline is a significant achievement, but earning a degree in a collegiate professional pilot program requires more than just academic success. The collegiate professional pilot student must not only take challenging science classes such as physics, aerodynamics, and meteorology, but they must also take regular flight lessons and pass multiple check rides to earn their Federal Aviation Administration (FAA) pilot certificates and ratings (Middle Tennessee State University [MTSU] Aerospace, 2024a). A full-time class load is between four and six classes every semester, and most collegiate flight training programs require students to fly or meet with their flight instructors for ground training at least three or four times a week. Flight lessons can take up to three hours depending on the lesson and the stage of training, and preparing for these flight lessons requires even more of the student's time (MTSU, 2024). According to the Aircraft Owners and Pilots Association (2010), 70 to 80 Percent of student pilots drop out before they ever obtain a student pilot certificate.

Many different factors have been studied to find a way to predict success in higher education programs. These factors include demographic and family characteristics, high school academic performance, college academic performance, standardized test scores, and placement in remedial courses (Stewart et al.2015). For example, Hepworth et al. (2018) focused on social integration, perceived institutional commitment to student success, and academic preparedness to predict academic success in an introductory Criminal Justice class at a public regional university. The results showed that only academic preparedness as measured by high school grade point

average (GPA) and the need for remedial courses predicted success in the course. Research has also focused on validating tests to predict success in collegiate professional pilot programs. For example, Mekhail et al. (2010) looked at testing perceptual speed or how quickly individuals can absorb and process visual search information with the Table Reading Test (TRT) to determine if it could predict pilot training success. The results demonstrated a significant relationship between the TRT scores and performance in a collegiate flight training program as measured by the number of flight hours accumulated before the first solo flight and successful completion of the Private Pilot check ride (Mekhail et al., 2010).

In addition to cognitive skills, there is growing interest in the relationship between non-cognitive skills and academic success. Noncognitive skills include the ability to deal with stress and are loosely defined as any skill that is not related to intellectual or thinking skills. Examples include resiliency and the ability to self-regulate. Resilience is the ability to handle setbacks effectively (Wong & Chapman, 2022). Self-regulation is related to what students know about themselves that will help them manage their learning efforts (Niemczyk & Ulrich, 2009). Other non-cognitive skills or attributes include self-efficacy and a sense of belonging. Self-efficacy is the belief that one can succeed at a task in a specific situation, and a sense of belonging is the feeling of being a valued member of a community of students, staff, and faculty (Tinto, 2017). See Table 1 for a summarized comparison of non-cognitive skills. A recent study by Wilson and Stupinsky (2021) focused on motivation as a predictor of academic achievement in an upper-level collegiate aviation classroom. Using a modified version of the Science Motivation Questionnaire II, the study found a strong relationship between self-efficacy and academic achievement.

Table 1

Non-cognitive Skills Definitions

Non-cognitive Skill	Definition
Resilience	The ability to handle setbacks
Self-regulation	Self-Knowledge that helps with managing learning efforts
Self-efficacy	The belief that one can succeed at a task in a specific situation
Sense of belonging	The feeling of being a valued member of a community of students, staff & faculty

Two non-cognitive attributes that have attracted considerable attention are grit and growth mindset. Recent research has demonstrated a strong relationship between grit, growth mindset and persistence in different academic environments. Grit is defined as perseverance and passion for long term goals (Duckworth, 2016), and growth mindset is the belief that intelligence can be developed and is not fixed (Dweck, 2016). Reysen et al. (2019) focused on the relationship between grit, educational attainment, and academic success as measured by credit hours attempted, semester GPA, cumulative GPA, and total number of credit hours attempted. In addition, grit scores of academically at-risk students with less than a 2.0 GPA were compared to students who were not at risk. The data analysis indicated that students who were not-at-risk had higher average grit scores than at-risk students. In addition, there were significant correlations between grit scores and cumulative GPA, semester GPA, and overall GPA.

Adusei-Asante and Doh (2016) define attrition as a decline in the number of students who initially enroll in a course of study by the end of the course. The attrition rate of first year full-time four-year college students is high. Twenty-three percent of new full-time students who enrolled at

four-year colleges and universities in 2008 did not return the following fall semester (Stewart et al., 2015). The attrition rate for first year collegiate professional pilot students has been high as well (Beckman & Barber, 2007). Collegiate aviation programs are an important source for new entry level commercial pilots. So, one way to ensure the continued growth and success of the commercial aviation industry is to decrease the attrition rate of first year collegiate professional pilot students by addressing the factors that lead to retention and successful completion. According to the National Student Clearinghouse Research Center (2024), retention is the percentage of students who return to the same institution, while persistence is measured by the percentage of students who return to college at any institution for their second year. In this report, the terms retention and persistence are used interchangeably.

History of Pilot Shortage

The commercial aviation industry is faced with a shortage of qualified commercial pilots due to retirements and increased demand for air transportation. Boeing estimated that there will be a need for 602,000 new pilots to accommodate the growth of commercial aviation by 2041. The global commercial aircraft fleet is predicted to double in the next 20 years (Boeing Report, 2022). As a result, increasing the number of qualified commercial pilots is critical for the future success of the commercial aviation industry.

Pilot shortages are not new to the airline industry. Shortages occurred in the 1960's due to the Vietnam War which absorbed a large portion of the U.S. population. As a result, there were a limited number of qualified individuals who could be trained. The current shortage of qualified pilots is the result of several different factors. Thousands of senior pilots will be required to retire in the next two decades due to the Federal Aviation Administration's mandatory age 65 retirement rule. The COVID-19 pandemic worsened the situation when the airlines offered early retirement

packages to deal with the decline in air travel. Thousands of senior pilots took early retirement as a result, and the pace of training new qualified pilots was significantly impacted (Pik, 2022).

Another factor that has contributed to the pilot shortage is the so-called 1,500-hour rule. Based on a Congressional mandate in 2013, pilots must now obtain an Airline Transport Pilot (ATP) certificate to be eligible to fly for a scheduled airline. On February 12, 2009, Colgan Air Flight 3407 crashed on approach to the Buffalo-Niagara International Airport killing all 49 passengers and crew plus one individual on the ground. After the investigation, the NTSB determined that the pilots reacted improperly to the aircraft stall warning system (Pik, 2022). Due to public pressure, Congress required the FAA to change the minimum requirements to fly for a scheduled airline. Pilots must now have the ATP certificate, which can require as much as 1,500 hours of total flight time. Before this change, pilots legally only needed 250 hours and a Commercial Pilot certificate to qualify as a first officer for a scheduled airline, although very few were hired with that minimal amount of time. This new requirement has significantly increased the time it takes for a pilot to qualify as a first officer. As a result, the number of qualified pilots has decreased significantly.

Restricted ATP Certificate Requirements

The FAA established a Restricted Airline Transport Pilot Certificate (R-ATP) concurrently with changing the requirement to have an ATP to fly for a commercial airline which allows approved higher education institutions to certify graduates of aviation degree programs for restricted ATP privileges with less than 1,500 hours of total flight time. A pilot who has earned the R-ATP may serve as a co-pilot until accumulating the required 1,500 hours of flight time for the unrestricted ATP (FAA, 2024, May 30). The reduction of required hours of flight for R-ATP

eligibility varies according to the aviation degree earned by the student. Table 2 gives a breakdown of the applicable reduction in required hours of flight for each degree.

Table 2

Reduction of Required Flight Hours for R-ATP eligibility

1,000 hours for a graduate who holds a bachelor's degree with an aviation major, completes 60 credit hours of approved aviation courses and meets the remaining requirements of § 61.160(b)
1,250 hours for a graduate who holds a bachelor's degree with aviation major, completes 30 credit hours of approved aviation courses and meets the remaining requirements of § 61.160(d)
1,250 hours for a graduate who holds an associate degree with an aviation major, completes 30 credit hours of approved aviation courses and meets the remaining requirements of § 61.160©

(FAA. 2024, May 2)

Part 141 Collegiate Professional Pilot Programs

Middle Tennessee State University (MTSU) is one of the higher education institutions approved by the FAA to certify graduates for the R-ATP. Sixty credit hours of approved aviation courses are required to qualify for the reduction in required flight hours. In addition, all flight training from the FAA Instrument Rating through the Commercial Multiengine Certificate must be earned at the MTSU Part 141 flight school (MTSU, 2024). Part 141 flight schools are certified by the FAA and must meet specific regulatory requirements that are described under Title 14 of the Code of Federal Regulations (CFR). These requirements include minimum personnel, aircraft, and facilities (Part 141 Schools, 1997). The curriculum must also meet minimum requirements which must be noted in the school's Training Course Outline (TCO). The TCO is approved and

kept on file at the local Flight Standards District Office (FSDO). Any changes to the TCO must be submitted and approved before implementation (Part 141 Schools, 1997).

Upon graduation, the student receives a certificate which states that the requirements for the R-ATP have been met. Most students in the professional pilot concentration go on to earn the Certified Flight Instructor (CFI) Certificate which allows them to teach and build the required flight hours for the R-ATP. Many MTSU professional pilot students are hired to teach at the MTSU flight school after earning the CFI Certificate. The time required to accumulate the flight hours needed for the R-ATP varies depending on the flight school and the number of available flight students. It can take from two to three years to accumulate the minimum flight hours required before a pilot can legally fly for a scheduled airline.

Problem Statement

Earning an aviation degree while training for pilot certificates and ratings is a challenge that requires significant effort, perseverance, and the resilience to bounce back from setbacks such as flight lesson cancellations and failed check rides. The attrition rate for first year full-time college students is high. Stewart et al. (2015) noted that 23 percent of new full-time students who enrolled at four-year colleges and universities in 2008 did not return the following fall semester. Research by Beckman and Barber (2007) found the attrition rate for first year collegiate professional pilot students to be as high as 51%, and the major reason given by professional pilot students who switched from the professional pilot concentration was the high cost of flight training. This finding was confirmed by a survey of student pilots, pilots, and flight instructors by the Aircraft Owners and Pilots Association (2010) when they were asked to cite negative aspects of their flight training experience. This high attrition rate is not only a problem for the institutions that offer professional pilot degree programs, but it is also a problem for the commercial aviation industry. The continued

success of the commercial aviation industry is dependent on the supply of qualified personnel. If less than 50% of first year professional pilot students manage to graduate, the need for qualified entry level commercial pilots will be difficult to meet. Collegiate aviation programs are a significant source of entry level pilots for the commercial aviation industry. So, it is important to identify traits and skills that can increase the number of students who successfully complete these programs to help resolve the shortage of qualified Commercial pilots. This will not only help identify students who are more likely to graduate, but it will also enable institutions to design training programs that help students develop these helpful traits and skills. The problem that is the focus of this study is the high attrition rate of students in collegiate professional pilot programs.

Purpose of Study

The purpose of this study was to determine if students who enroll and eventually graduate in a collegiate professional pilot program differ significantly in grit and growth mindset than students who enroll in a collegiate professional pilot program but graduate in another concentration. Angela Duckworth's Grit-S Scale was used to measure grit (Duckworth & Quinn, 2009), and Carol Dweck's mindset survey was used to measure growth mindset (Dweck, 2016). Then a purposeful sample of students from each group was asked to participate in an interview to determine if there is a difference in the educational experiences between students who enroll and subsequently graduate in the Professional Pilot concentration and students who enroll in the Professional Pilot concentration and subsequently switch to another Aerospace concentration.

Significance of Study

Collegiate professional pilot programs are a good source of entry level commercial pilots because they are eligible for the R-ATP. This advantage allows them to get hired much earlier than

pilots who are not eligible for the R-ATP. The United States commercial aviation industry relies on both regional and major airline services. The regional airlines have rapidly expanded over the past two decades, serving over 670 airports and transporting 163 million passengers (Smith et al., 2013). Regional airlines typically hire less experienced pilots to maintain low operating costs because of this growth. Due to a combination of factors, the pool of qualified pilots has been insufficient to meet the needs of the regional airlines. After the Colgan Air 3407 accident in 2009, the Airline Safety and Federal Aviation Administration Extension Act of 2010 directed the FAA to modify training requirements for Pilots hired for scheduled air carriers. In the Advanced Notice of Proposed Rulemaking (ANPRM), the FAA was tasked with gathering information on the training and qualification for commercial pilots and asked for recommendations. One question that was of particular interest to aviation educators was whether graduates of accredited collegiate aviation programs had more academic knowledge than other pilots. This led to the 2010 Pilot Source Study (Smith et al., 2010) which was conducted by researchers from six regional airlines and five independent universities with professional pilot degree programs. The researchers sought answers to the following questions: What were the characteristics of pilots who were hired by the U.S. regional airlines between 2005 and 2009 and how did these characteristics relate to their success in regional airline training programs (Smith et al., 2010)? The results of this research confirmed that pilots with an aviation degree required fewer extra training events and had fewer initial training failures. In addition, pilots who were trained at a college or university accredited by the Aviation Accreditation Bureau International (AABI) had even fewer extra training events and initial training failures. This was confirmed in a follow up study in 2013 (Smith et al., 2013). Although the most successful pilots came from AABI accredited aviation programs, they accounted for a small percentage of pilots in these studies. Unfortunately, the number of pilots

produced by these programs will not be enough to meet demand unless the production of successful pilot applicants by these collegiate professional pilot programs is increased. Therefore, decreasing the high attrition rate in these programs is critical to the future success of the commercial aviation industry. If students who score high in grit and growth mindset are more likely to succeed and graduate, testing potential students for these traits and providing training to enhance these traits may increase the number who are successful.

Research Questions

The following research questions were asked to determine whether grit and growth mindset can predict success in a collegiate professional pilot program:

1. Is there a difference in grit scores between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?
2. Is there a difference in growth mindset between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?
3. What is the difference between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration?

Context

Participants in this study included MTSU juniors and seniors who were majoring in Aerospace with concentrations in Aviation Management, Aviation Maintenance Management, Unmanned Aircraft Systems (UAS), Professional Pilot, Aerospace Technology, and Flight

Dispatch. These participants were recruited from upper-level classes in the Aerospace Department during the Fall 2024 semester. Many of these students initially enrolled in the Professional Pilot concentration but decided to change their concentration for different reasons. Research by Beckman and Barber (2007) compared the attrition rates of MTSU students who first enrolled in the Professional Pilot concentration and students enrolled in one of the other Aerospace concentrations. The attrition rate for the Professional Pilot concentration was three times the combined attrition rate in the other concentrations, and the most common reason students cited for changing concentrations was financial. This study included a similar population of students at MTSU, but the focus was on the roles of grit and growth mindset in the decision to remain in the Professional Pilot concentration until graduation or switch to another Aerospace concentration.

Role of Researcher

As the primary investigator in this study, I personally visited upper-level Aerospace classes at MTSU to recruit students to complete the Grit-S and the Growth Mindset measurement instruments. I also personally selected the students for the purposeful sample to be interviewed for the qualitative portion of this explanatory sequential mixed methods study and conducted the interviews. Students were randomly selected for the interviews to see if there is a difference in educational experiences. I transcribed and coded the interviews, developed themes, and related those themes to the theories employed in the conceptual framework of this study.

My background includes over 20 years in the aviation education and training field. Many of my students have experienced difficulties in achieving their goals, but most were able to overcome their difficulties and do well. Occasionally, students fail to overcome barriers and achieve their goals when other students of similar intelligence and ability persevere through difficulties and eventually succeed. There have been many times in my own life when I faced

obstacles to achieving personal goals, and I believe that the main reason that I have managed to succeed is because I am able to persevere through difficulties in pursuit of my long-term goals. I also believe that anyone can grow their intelligence through effort. As a believer in lifelong learning, I have continued my education when most people my age are getting ready to retire. My experience as an educator and my own personal experience enhanced my awareness of how non-cognitive traits like grit and growth mindset can contribute to success in a collegiate professional pilot program. As someone who believes that anyone can be successful with the right attitude, I may bring certain biases to this study. However, my awareness of these biases helped ensure that I avoided allowing these biases to influence the results of this study.

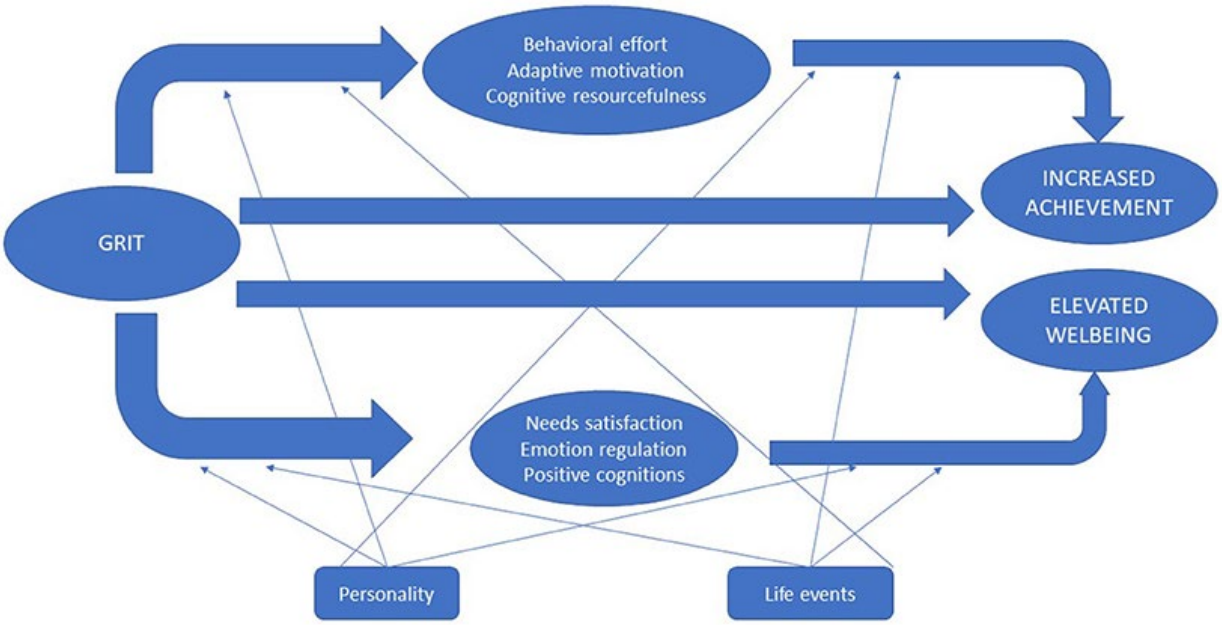
Conceptual Framework

In Figure 1, Datu (2021) proposed the optimal performance and health (OPAH) model of grit. The OPAH model was proposed to address how grit predicts positive outcomes. Figure 1 illustrates how grit affects achievement and wellbeing through effort, motivation, resourcefulness, needs satisfaction, emotional regulation, and positive cognition. This research study was built around the conceptual framework of grit and growth mindset and how these non-cognitive traits influence success and retention in a collegiate professional pilot program.

The title of the first chapter in her book *Grit: The Power of Passion and Perseverance* (Duckworth, 2016) is “Showing Up.” Woody Allen is credited with saying that ninety percent of success in life is just showing up. Although Woody Allen was not a social scientist by any stretch of the imagination, it does lend some support to the theory of grit. The theory of grit is defined as perseverance and passion and for long-term goals (Duckworth, 2016). There has been considerable

Figure 1

The Optimal Performance and Health (OPAH) Model of Grit.



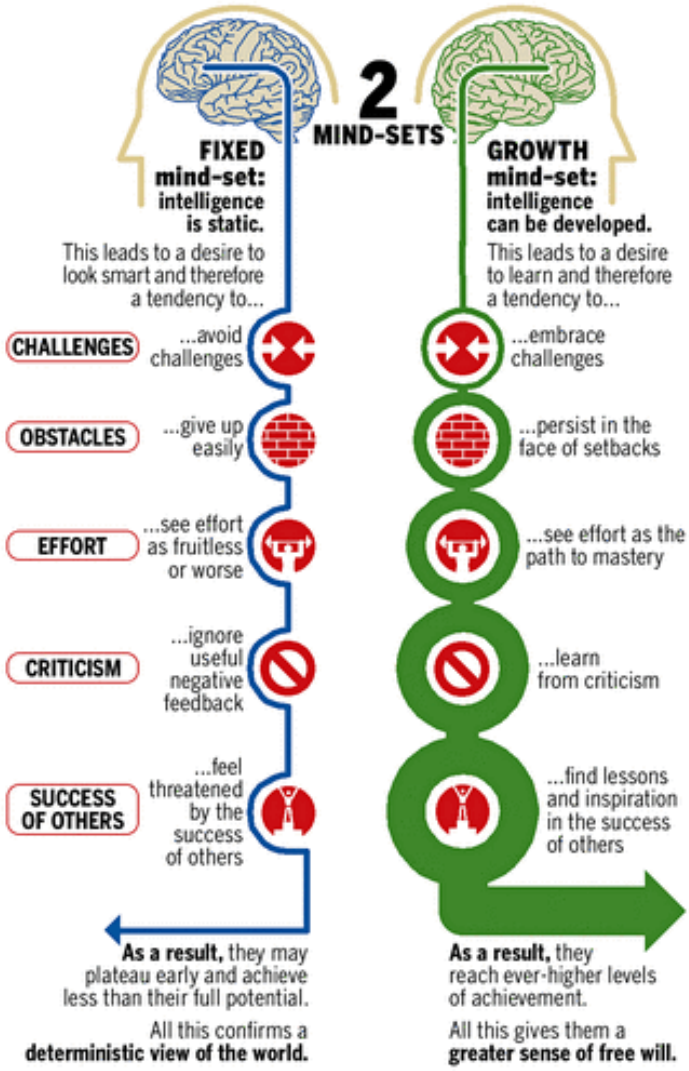
Datu (2021)

research on how grit is related to academic performance and retention. Students who score high in grit are more successful in higher education than students who score low (Duckworth & Quinn, 2009). Undergraduate students in the United States who score high in grit demonstrate higher persistence than those who score low (Saunders-Scott et al., 2018). High school and university students in the Philippines with high grit scores exhibit higher academic engagement (Datu et al., 2018). A search for research on grit and persistence in a collegiate professional pilot program was conducted and there has been no research on this topic to date. The goal of this research is to fill this gap in the body of knowledge.

The second theoretical concept addressed by this research is called mindset which is the brainchild of Stanford University psychologist Carol S. Dweck. According to Dweck (2016), there are two types of mindsets which can determine an individual's level of achievement. Growth mindset is defined as the belief that intelligence is not fixed and can be improved through effort.

Figure 2

The Difference Between a Fixed Mindset and a Growth Mindset



(Dweck, 2016)

Alternatively, people with a fixed mindset believe that intelligence is fixed and cannot be improved upon (Dweck, 2016). Like the theory of grit, there has been considerable research on the effect of mindset on educational achievement and student outcomes (Yeager & Dweck, 2020), but there has been no research on how mindset affects success and persistence in collegiate professional pilot programs.

Figure 2 illustrates the difference between a fixed mindset and a growth mindset. According to Dweck (2016), a fixed mindset or a belief that intelligence is static will lead individuals to avoid making mistakes because of a desire to look smart. As a result, individuals with a fixed mindset avoid challenges, give up easily, view effort as useless, ignore negative feedback, and feel threatened by the success of others. Because of their fixed mindset, these individuals tend to plateau early in life and fail to achieve their full potential. Those with a growth mindset feel that intelligence can be improved with effort. As a result, they tend to embrace challenges, persist in the face of setbacks, see effort as a path to mastery, learn from criticism, and are inspired by the success of others. These individuals tend to achieve high levels of success.

Limitations and Delimitations

The results of this research may be limited because the participants were confined to students enrolled at a single university. Also, the participants were limited to students who either switched from the professional pilot concentration to another aerospace concentration before graduation and students who initially enrolled and eventually graduated in the professional pilot concentration. Contact information was not available for professional pilot students who left the university all together or who switched to another academic discipline. As a result, there was no way to include students who dropped out of the university, transferred to another university, or

transferred to another college within the university. Finally, there is always the possibility of researcher bias in any qualitative study.

Definitions and Abbreviations

- AABI is the abbreviation for the Aviation Accreditation Bureau International.
- ATP is the abbreviation for Airline Transport Pilot.
- Attrition is a decline in the number of students who initially enroll in a course of study by the end of the course.
- CFI is the abbreviation for Certified Flight Instructor.
- CFR is the abbreviation for the Code of Federal Regulations.
- Cognitive skills are abilities and skills related to thinking, paying attention, processing information and memory.
- EOC is the abbreviation for end of course which is the last course in a flight lab.
- FAA is the abbreviation for the Federal Aviation Administration.
- A fixed mindset is the belief that intelligence is fixed (Dweck, 2016).
- GPA is the abbreviation for Grade Point Average.
- Grit is perseverance and passion for long-term goals (Duckworth, 2016).
- Growth mindset is the belief that intelligence is not fixed and can be improved through effort (Dweck, 2016).
- MTSU is the abbreviation for Middle Tennessee State University.
- Non-cognitive skills are also known as soft skills such as motivation, integrity, and interpersonal communication.
- NTSB is the abbreviation for National Transportation Safety Board.

- Persistence is the percentage of students who return to college at *any* institution for their second year.
- R-ATP is the abbreviation for Restricted Airline Transport Pilot.
- Resilience is the ability to handle setbacks effectively (Wong & Chapman, 2022).
- Retention is the percentage of students who return to the *same* institution.
- Self-efficacy is the belief that one can succeed at a task in a specific situation (Tinto 2017).
- Self-regulation is self-knowledge that helps individuals manage their learning efforts (Niemczyk & Ulrich, 2009).
- Sense of belonging is the feeling of being a valued member of a community of students, staff, and faculty (Tinto 2017).
- TRT is the abbreviation for Table Reading Test.
- UAS is the abbreviation for Unmanned Aircraft Systems.

Summary of Chapter 1

Prior research on academic success and persistence in collegiate professional pilot programs has focused on factors such as demographics, family characteristics, high school GPA, standardized test scores, and college GPA (Stewart et al., 2015). There is also growing interest in the relationship between non-cognitive skills and academic success and achievement. One non-cognitive skill is resilience which is the ability to handle setbacks effectively. This research is focused on how two non-cognitive traits known as grit and growth mindset affect retention in a collegiate professional pilot program. Although the attrition rate for first-year college students in the United States was as high as 23 percent in 2008 (Stewart et al., 2015), one study found that the attrition rate for students in a collegiate professional pilot program was two times higher (Beckman & Barber, 2007). There is currently a shortage of commercial pilots qualified to fly for scheduled

airlines due to retirements, the COVID-19 pandemic, fluctuating economic conditions, and other factors. Collegiate professional pilot programs have been instrumental in supplying qualified entry level commercial pilots to the commercial aviation industry. However, the high attrition rate of students enrolled in these programs will make it impossible for collegiate professional pilot programs to meet the future demands for new entry level pilots. According to Boeing, there will be a need for 602,000 new pilots by 2041, and the global commercial aircraft fleet will double in the next 20 years (Boeing Report, 2022). Increasing the supply of qualified commercial pilots will be necessary for the continued success of the commercial aviation industry. Collegiate professional pilot programs have been a good source for well qualified entry level commercial pilots. One way to address this problem will be to increase the retention of these students so that more of them will graduate and take their places on the flight decks of the nation's commercial airliners. If students who score high in grit and growth mindset are more likely to persist and graduate, it may be possible to increase the retention rate by cultivating these traits in collegiate professional pilot students. This study sought to understand how success in a collegiate professional pilot program is related to the non-cognitive traits of grit and growth mindset. In addition, students were interviewed to determine the difference in personal and educational experiences between students who enrolled and will eventually graduate in the Professional Pilot concentration and those who enrolled in the Professional Pilot concentration but subsequently switched to another Aerospace concentration. Understanding these differences should help higher education institutions design interventions that will promote these non-cognitive traits and increase the number of potential graduates.

CHAPTER II: LITERATURE REVIEW

Previous research on collegiate professional pilot student retention has focused on factors such as high school GPA, ACT scores, age, gender, financial resources, student engagement, and prior knowledge of the aviation industry (Beckman & Barber, 2007). Although relationships have been found between these factors and success in a collegiate professional pilot program, the results have been mixed. The high attrition rate in higher education is not only a serious problem for students, but it is also an issue for the schools that serve them due to significant decreases in enrollment (Wong & Chapman, 2024).

Factors Related to Persistence in Higher Education

According to a study by Stewart et al. (2015), data from the National Center for Educational Statistics indicated that 23% of all first year full-time four-year college students did not return the following fall semester in 2008. The purpose of this study was to identify factors that influence student retention, which has been a major concern for colleges and universities. The focus of their research was the relationship between persistence of first-time college students and variables such as demographics, family characteristics, high school GPA, first-semester college GPA, and placement in remedial courses at a large public research university. Remedial education was defined as "coursework that compensates for a lack of basic reading, writing, and arithmetic skills necessary to succeed in a college-level course" (Stewart et al., 2015, p.12). The theoretical framework employed was Tinto's longitudinal model of institutional departure (Tinto, 1993).

The data indicated that 60.5% of students who took remedial courses persisted for five or more semesters and 39.5% persisted four or less semesters compared to 73.2% and 26.8% respectively for students who did not take remedial coursework. Positive correlations were found

between persistence and high school GPA, ACT scores, and first semester college GPA. High school GPA and first semester college GPA explained 26% of persistence. First semester college GPA was strongly correlated with persistence. However, there was an inverse relationship between high school GPA alone and persistence. The authors concluded that high school GPA may not be a factor that predicts retention beyond the first year of college (Stewart et al., 2015). The rest of the independent variables (gender, ethnicity/race, ACT score, income, financial aid, and remedial coursework) did not significantly contribute to the final multiple regression model (Stewart et al., 2015). The authors concluded that students who came to college academically prepared were more likely to persist than students who were required to take remedial courses (Stewart et al., 2015). Thus, early intervention and resolution of academic deficiencies is critical for ongoing student success and retention. The authors recommended tutoring, academic advising and counseling programs aimed at helping students who were not prepared in high school for college-level coursework (Stewart et al., 2015). Similar results have been found in other studies. For example, Hepworth et al. (2018) found that only academic preparedness as measured by high school grade point average (GPA) and the need for remedial courses predicted academic success (Hepworth et al., 2018). Allen et al. (2008) found that high school grades along with tests of academic achievement are the best predictors of academic success and persistence.

Vincent Tinto served as Chair of the Higher Education Program and is a Distinguished University Professor Emeritus at Syracuse University. He has published extensively on student success and the impact of learning communities on student success and persistence. He wrote an article in reference to papers selected for a special STARS (Students, Transitions, Achievement, Retention, and Success) Conference issue of the Journal of Student Success. This article explored

how student motivation is influenced by student self-efficacy, sense of belonging, and the perceived value of the curriculum (Tinto, 2017).

Tinto (2017) began this article with a question: "What can universities do to improve student retention?" Although it is obviously in the best interest of universities to increase retention, Tinto (2017) argued students look at the issue from a different point of view. They are not concerned about being retained. Rather, they are more concerned about persistence to degree completion whether it means completing a degree at the student's original institution or transferring to another college or university (Tinto, 2017).

Bandura (1977) defined self-efficacy as a person's belief that they can succeed at a given task in a specific situation. Self-efficacy is achieved through past experiences which leads to the perception of control over the environment. An individual with a strong sense of self-efficacy will take on difficult tasks and persist until they are completed. Indeed, a sense of self-efficacy is one of the foundations of student success. Tinto (2017) emphasized that self-efficacy is gained through experience, and many students come to college with a strong belief in their ability to be successful. However, many students may not initially possess this belief, and some may experience difficulties that ultimately reduce their self-efficacy. To prevent this from occurring, colleges and universities must provide support early before academic difficulties result in the loss of self-efficacy (Tinto, 2017).

The belief that one can succeed is important, but Tinto (2017) cautioned that self-efficacy alone is not enough to ensure student success. In addition to a belief in one's ability to succeed, students must be engaged in a community of students, faculty, and staff to achieve a sense of belonging. Students can achieve a sense of belonging through extracurricular activities or peer to peer programs that lead to engagement with other people (Tinto, 2017). Forming a bond with

students who share a common background or interest can lead to persistence because a student who feels that he or she belongs to a specific group will be more motivated and willing to be involved with others. Students who avoid contact with others may not feel a sense of belonging which can decrease motivation and lead to a feeling that one does not belong in higher education. Adusei-Asante and Doh (2016) reviewed existing research on student retention in higher education and concluded that building engagement and belonging was critical in promoting retention. They found that higher education institutions that designed systems to promote student engagement and belonging were more successful in retaining students. These systems included peer mentoring programs and meaningful interaction between students and staff members (Adusei-Asante & Doh, 2016). In a longitudinal study tracking beginning higher education students from 2004 through 2009, Flynn (2014) found that academic and social engagement has a significant positive effect on retention and graduation. Academic engagement included meeting with faculty outside of class, meeting with academic advisors, and study group participation. Social engagement was defined as attendance at art or drama performances, club participation, and participation in sports. The results of this longitudinal study supported Tinto's theory that students who are more academically and socially engaged will be more likely to succeed and graduate. Tinto (2017) recommended that colleges and universities try to make their institutions as welcoming as possible providing opportunities to work together in cohorts and social groups and organizations where students can find a community that will provide a common bond (Tinto, 2017). A sense of belonging and forming bonds with students who share a common background is central to Tinto's theory. However, Braxton et al. (2014) pointed out that there were important differences between residential and commuter colleges and universities because of fundamental differences between these different institutions of higher education. Commuter college and university students include

both traditional and non-traditional students including older students with family and job obligations. Commuter colleges and universities do not feature the same well-defined social communities that usually are an important part of residential colleges and universities. As a result, the need for community may not be as important to students at commuter colleges and universities (Braxton et al., 2014).

Students also must perceive that the curriculum they are being asked to learn is valuable and relevant to their futures. Students who perceive that the curriculum is relevant and the material that is taught is of high quality will be more likely to persist. Tinto (2017) recommended that institutions ensure students are enrolled in a field of study that is congruent with their interests and long-term goals. In addition, faculty should demonstrate how the material that is taught in first-year introductory courses is applied to meaningful situations that are relevant to student interests. This can be done through project-based learning that requires the student to solve real world problems (Tinto, 2017).

Tinto (2017) concluded by saying he does not recommend that universities stop their efforts to retain students, nor does he suggest that their efforts are misguided. Rather, he recommended that universities look at student success from the student's perspective. Universities must look at persistence through the eyes of the students to understand how their experiences influence their motivation to earn a degree (Tinto, 2017). To promote student success, universities should ask themselves what can be done to influence students' desire and ability to complete their degree programs.

One of the factors that has a significant impact on retention is academic stress which occurs due to the increasing demands experienced by higher education students during the academic year (Wong & Chapman, 2024). Research by Wong and Chapman (2024) studied the relationship

between college students' non-cognitive profiles with academic stress and persistence in higher education to understand factors that lead to the retention of college students in their chosen fields of study. The negative effects of academic stress include physical and mental health problems such as chronic fatigue, anxiety, and depression. These physical and mental health problems significantly decrease the ability to succeed and persist to graduation. Perseverance and determination toward long-term goals such as a college degree requires both cognitive and non-cognitive abilities and skills (Wong & Chapman, 2024). Cognitive skills are related to intellectual abilities such as problem solving and thinking. Non-cognitive skills are related to abilities that help students cope and succeed with academic demands. Several studies have identified six non-cognitive skills that help students manage their stress and increase persistence: career aspirations, academic motivation, learning approaches, self-regulated learning (SRL), growth mindsets, and resilience (Wong & Chapman, 2024). Prior research has focused on the relationship between non-cognitive skills and academic performance, with only a few studies that focused on the relationship between stress and retention. Most of these studies have investigated the relationship between one of these non-cognitive skills and academic performance in isolation which fails to consider the effect of different non-cognitive traits on each other. Wong and Chapman (2024) felt that a student's full profile of non-cognitive abilities was more likely to predict academic achievement. To address this gap in the literature Wong and Chapman (2024) categorized the different non-cognitive profiles of higher education students in Singapore and then looked at the relationship between the different profiles and the level of academic stress and intent to persist. The results showed a significant difference in stress and persistence between the three groups with the high non-cognitive readiness group exhibiting lower stress levels and higher levels of persistence than the moderate and low non-cognitive readiness groups (Wong & Chapman, 2024). In another study

that reviewed research concerning how academic stress is related to academic achievement in Chinese adolescents, Ye et al. (2019) concluded that while there is a negative relationship between the stress experienced by Chinese adolescents and academic achievement, there were other factors that moderated the strength of the relationship including a belief in the value of education, resilience, and the severity of academic stress. Other factors included financial and interpersonal stress. Another study by Lysnyj et al. (2023) reviewed 14 peer reviewed research studies that focused on the relationship between perceived stress and the academic success of post-secondary students. The results revealed a statistically significant relationship between perceived stress and academic success with coinciding intrapersonal and interpersonal factors that were associated with the relationship. Wong and Chapman (2024) stated in their discussion that the results confirm a significant relationship between non-cognitive traits, stress levels, and intention to persist and demonstrate how these attributes may collectively explain why some students persist while others do not. Recommendations for higher education institutions included focusing on the development of non-cognitive readiness to improve academic performance and reduce attrition rates (Wong & Chapman, 2024).

The research described thus far focused on success and persistence in four-year academic programs but did not focus on any specific academic discipline. Due to concerns over a predicted shortage of qualified commercial pilots, considerable research has attempted to identify factors that lead to higher retention rates in pilot education and training programs. The following research studies were focused specifically on this issue.

Factors Related to Persistence in Collegiate Professional Pilot Programs

Just as researchers in higher education have investigated the influence of pre-entry student attributes on student success and persistence, aviation education researchers have also sought to

understand how pre-entry attributes can lead to success in a collegiate professional pilot program. Aviation researchers Bjerke and Healy (2010) sought to identify pre-entry attributes that might help predict persistence in a collegiate flight training and education program. Their study was conducted at a public university that offered a commercial aviation degree program. They looked at two different cohorts of students to obtain a large enough sample. These cohorts consisted of commercial aviation students who began in the fall of 2006 and another who began in the Fall of 2007 (Bjerke & Healy, 2010). Existing data was obtained from the university academic records and financial aid records. This data included high school grade point average, ACT scores, gender, age, ethnicity, high school, family income, parents' education level, and the number of admitted credit hours for each student. The dependent variables included persistence in the spring and the following fall semester and the students' grade point average (Bjerke & Healy, 2010). The analysis revealed that there was a relationship between pre-entry attributes and persistence between the students' first and second year (Bjerke & Healy, 2010). The most significant relationship was between high school grade point average and persistence. In addition to persistence, data concerning students who changed majors between the first and second years was analyzed which determined that there was no relationship between pre-entry attributes and declared major (Bjerke & Healy, 2010). High school grade point average had the most significant effect on academic success in the fall semester of college. Bjerke and Healy (2010) recommended that admissions policies should be based less on standardized test scores and more on a student's high school grade point average. The results also indicated that there was a relationship between academic success and parent education level and income, but this may have more to do with parents who can afford to pay for this relatively high-cost degree program (Bjerke & Healy, 2010).

In another study, data from the Federal Aviation Administration was cited that showed a steady decline in the number of Private Pilot Certificates and Commercial Pilot Certificates from 2002 to 2006 as evidence that the number of qualified pilots has decreased despite industry attempts to increase interest in pilot careers (Beckman & Barber, 2007). Collegiate aviation programs have been a significant source of entry-level pilots for the regional airline industry which makes increasing the retention of students in professional pilot programs a critical factor in managing the shortage of qualified pilots. Beckman and Barber (2007) looked at the retention rate of students enrolled in a collegiate professional pilot program and the factors that motivate students who initially enroll in the professional pilot concentration to change their concentration before graduation. In addition, they looked at the differences in these factors between students in the professional pilot concentration and other Aerospace concentrations. Data was collected through a survey sent to graduating seniors who were enrolled in an Aerospace Seminar at Middle Tennessee State University. All graduating seniors in every Aerospace concentration were required to enroll in this Aerospace Seminar as a capstone course to graduate. Ten questions in the survey were designed to address factors that may cause students to change their concentration before graduation. These questions asked about previous knowledge of aviation careers, financial constraints, student loan amounts, time constraints, and future job prospects (Beckman & Barber, 2007). Finally, participants were asked which Aerospace concentration they initially selected, when they made their initial selection, and which concentration they expected to be in when they graduate. The data was analyzed to determine the differences between the students enrolled in the Professional Pilot concentration and students enrolled in the other Aerospace concentrations (Beckman & Barber, 2007).

Out of the four Aerospace concentrations, the Professional Pilot concentration had the highest attrition rate at 51% compared to the other concentrations which had a combined 16% attrition rate. Most of the students who left the Professional Pilot concentration switched to Aviation Administration and Dispatch/scheduling (Beckman & Barber, 2007). Also, students in the Professional Pilot concentration reported lower participation rates in Aerospace student organizations. Encouragement to participate in student organizations may help students establish relationships with faculty and other students which could help with persistence in the Professional Pilot concentration (Beckman & Barber, 2007). Finally, the most common reason for leaving the Professional Pilot concentration was financial. Therefore, the authors recommended greater efforts to make students aware of financial aid and scholarship opportunities. Reducing the cost of training by increasing the use of simulators was also recommended to reduce the cost of flight training (Beckman & Barber, 2007). Research results focused on the impact of living and learning communities on aviation student success and retention lends support to the idea that student engagement with faculty and other students has a positive effect on academic success and persistence. Wilson et al. (2015) compared the academic performance and retention of first year aviation students who were assigned to live in an Aviation Living and Learning Community (ALLC) with the academic performance and retention of first year aviation students who were not assigned to live in an ALLC. Aviation students who requested to live in the ALLC were assigned to live in a campus residence hall with other first year aviation students. Although there was no significant difference in retention rates between the two groups, Wilson et al. (2015) found that aviation students living in an ALLC earned significantly higher grades than students who did not live in an ALLC.

A more recent study by Osman et al. (2022) looked at the effect of 19 factors on graduation persistence and time to graduate in a collegiate aviation program. These factors included age, number of transfer credits, class load, and aeronautic course pass rates (Osman et al., 2022). Due to a decline in the number of commercial pilots since 2009 and the projected increase in air travel, the need to understand the factors that lead to pilot-in-training success and persistence to graduation is critical according to the authors. Although prior studies have identified many different factors such as academic success, flight training costs, and class load that influence persistence in a collegiate professional pilot program, more research is needed to understand how these factors work together, and which factors have the greatest ability to increase success and retention. Osman et al. (2022) focused on 19 variables identified by prior research to identify the ones that were most influential. These variables were organized into five functional sets. The first set was labeled individual differences. The second set was labeled involvement variables. The third set was labeled achievement variables. The fourth set was labeled instructor interaction variables, and the fifth functional set was labeled flight postponement variables (Osman et al., 2022). The goal of this research was to determine the relationship between these variables and time to graduate and persistence before dropout from a collegiate professional pilot program. The design of this research was ex post facto using existing data from the Office of Institutional Research at a Part 141 collegiate aviation program. Two hierarchical regressions were done with the 19 variables in five sets to determine their relationships with persistence before dropout and time to graduate (Osman, et al., 2022). Significant relationships with both persistence before dropout and time to graduation were found with age, transfer credits, class loads, and aeronautical class pass rates. Major code, success in aeronautical classes, and maintenance postponements were also significantly related to time to graduation. Finally, high flight costs, instructor changes, student

postponements, and weather postponements were significantly related to persistence before dropout (Osman et al., 2022). Recommendations included making older students aware of program and time requirements, encouraging students to take between 12 and 15 credits, minimizing postponements and making students aware of impacts on time to graduate, increasing oversight of transfer students to help them graduate on time, and limiting instructor changes (Osman et al., 2022).

Research by Leonard (2024) focused on how success in collegiate flight programs is affected by academic intensity. Based on Astin's IEO model (Astin, 1993) which measured student effort according to the length of time spent studying, Leonard's research sought to document a relationship between collegiate aviation students' academic intensity and success of degree completion. Academic intensity was defined as average semester credits, summer semester credits, flight hours required to complete training for the commercial pilot certificate, number of days required to complete training for the commercial pilot certificate, and stage check pass rate for the commercial pilot certificate (Leonard, 2024). The results demonstrated a significant relationship between the number of credits taken and graduation in 48 months. Also, students who enrolled in credit courses during the summer semesters were more likely to graduate in 48 months. Finally, the number of days and flight hours students took to complete commercial pilot flight training was significantly related to graduation in 48 months, and cumulative GPA was significantly related to the average number of credits taken in years two and three and the number of hours required to complete commercial pilot training (Leonard, 2024). Leonard (2024) recommended encouraging students to enroll in summer semester courses, advising students to take between 30 and 36 credit hours in their first year and maintaining or increasing credit hours as needed in years two and three.

In addition, Leonard (2024) recommended that collegiate flight schools minimize situations that lead to an increase in students' flight hours and days to complete flight training.

The aviation related research discussed thus far has focused on predicting professional pilot student success based on external factors such as high school GPA, standardized test scores, college GPA, class load, and aeronautical course pass rates. Other research has focused on the relationship between internal motivational factors and success in a collegiate aviation program. Wilson and Stupinsky (2021) modified the Science Motivation Questionnaire II (SMQ-II) to explore student motivation in a fourth-year aircraft systems course. The SMQ-II is designed to measure self-efficacy, self-determination, intrinsic motivation, career motivation, and grade motivation. These motivational factors were defined as follows:

- Self-efficacy is the belief in one's ability to be successful.
- Enjoyment or interest in a subject is the result of intrinsic motivation.
- Self-determination is autonomy or responsibility for an outcome.
- Career motivation is extrinsic motivation or the performance of an activity to achieve some outcome.
- Grade motivation is also extrinsic motivation where a high grade is valued as a reward for effort.

The purpose of this research was to evaluate the reliability and validity of the SMQ-II in a collegiate aviation environment and determine what motivators best predicted academic achievement in a collegiate aviation course of study. The SMQ-II was answered by 229 students enrolled in an advanced aircraft systems class at a university in the midwestern United States. Academic achievement was measured by calculating a composite exam score for each student. An

exploratory factor analysis was performed followed by a confirmatory factor analysis which found a strong relationship between self-efficacy and academic success. A moderate relationship was also found between self-determination and academic success.

Cognitive traits are related to conscious intellectual effort such as thinking and reasoning. Noncognitive traits are related to characteristics like motivation, self-confidence, and perseverance. The research reviewed thus far has focused on the effect of many different cognitive and noncognitive traits on success and persistence in higher education. These studies have demonstrated that high school GPA, first semester GPA, self-efficacy, sense of belonging, academic stress, academic intensity, student engagement, finances, age, transfer credits, class loads, and aeronautic class pass rates are all related to success and persistence in higher education and collegiate professional pilot programs. The noncognitive trait known as grit has received considerable attention recently with studies on the effect of grit on academic success and retention. Although there has been considerable research on the effect of grit on success and retention in higher education, there has been no research concerning the effect of grit on success and retention in collegiate professional pilot programs. The following review is focused on research that investigated the relationship between grit and persistence in higher education.

The Relationship Between Grit and Persistence in Higher Education

Angela Duckworth, Ph.D., is a well-known researcher and professor of psychology at the University of Pennsylvania. Early in her career, she worked for the New York City schools teaching seventh grade math to twelve- and thirteen-year-old students, most of whom lived in low-income housing projects. Duckworth's job was to help her students learn fractions, decimals, and the basics of algebra and geometry (Duckworth, 2016). She noticed that some of her students were able to learn these basic mathematical concepts easily while others struggled. However, some of these

students did not do as well as she expected at the end of the grading period while some of the students who struggled earned much higher grades than she expected (Duckworth, 2016). These students would always come to class, take notes, and ask questions. If they were unable to understand something initially, they would put in extra effort and sometimes come for extra help (Duckworth, 2016).

After her time at the New York City Schools, Duckworth moved to California and found a job teaching at a high school in San Francisco that accepts students based on academic performance. However, she soon realized that her students were unique not because of their IQ scores, but because of their work ethic (Duckworth, 2016). Most of the students spent hours every day studying, but not every student who expected to do well at math was able to excel. It was always the hardest workers who did well on quizzes and tests. Duckworth spent several years teaching and became convinced that effort was more important than talent in predicting academic success (Duckworth, 2016). She eventually left teaching for graduate school to become a psychologist in a quest to understand why some people with less talent are more successful than others with more talent. Duckworth eventually became a leading researcher on the concept of grit (Duckworth, 2016).

Grit is defined as “perseverance and passion for long term goals” (Duckworth et al.,2007, p. 1087). Duckworth et al. (2007) investigated the relationship between the noncognitive trait called grit and academic success. Cognitive ability, creativity, self-confidence, emotional intelligence, extraversion, and vigor were cited as some of the attributes found in successful people, and some of these attributes were described as more important than others for specific occupations such as extraversion for sales. This study sought to determine why some individuals accomplish more than others of equal intelligence (Duckworth et al., 2007).

One trait that was identified as shared by most leaders in almost every field was grit which was further defined as the ability to "work strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress" (Duckworth et al., 2007, pp. 1087-1088) Although intelligence has been documented to be strongly related to achievement in many fields according to many studies cited by Duckworth et al. (2007), a longitudinal study done by Terman and Oden (1947) of gifted children found that the most successful individuals had IQ's only 5 points higher than those who were the least successful. In addition, this study found that "perseverance, self-confidence, and integration toward goals was more predictive of future success than IQ" (Terman & Oden, 1947, p.351).

Duckworth et al. (2007) sought to address the relationship between grit and success by developing a measurement tool that was valid for both children and adults involved in different professional as well as academic pursuits. They reviewed several published measurement tools, but there were no existing measurement tools that met their requirements. As a result, they designed and validated an instrument they called the Grit Scale (Duckworth et al., 2007). The questions were validated through volunteers recruited on a website that provides free information about psychology research. The instrument was developed to measure attitudes and behaviors common in high achievers. The result was a 12-item instrument that demonstrated high internal consistency ($\alpha = .85$) (Duckworth et al., 2007). The Grit scale was then employed in six separate studies. The results of these studies demonstrate that differences in grit between individuals predicted success more than IQ. Individuals with higher education levels tested higher in grit than those with less education, and older individuals were found to be higher in grit than younger individuals (Duckworth et al, 2007). In a study of West Point cadets, grit predicted retention rates after the first summer of training when 1 in 20 cadets typically drop out. Finally, in a study of

contestants in the Scripps National Spelling Bee, competitors who were higher in grit did better than those with lower grit scores (Duckworth et al., 2007). In the discussion of the implications of these studies, the authors suggested that grit might be as important as talent for high achievement and success in every field. If so, the authors recommended that children who demonstrate a singular passion and commitment to a goal should be supported just as much as those who are identified as gifted and talented. Parents and educators should encourage children to work toward long-term goals and teach that high achievement requires a long-term commitment (Duckworth et al., 2007).

Miller-Matero et al. (2018) sought to identify factors that might predict success in medical school. Although previous research has identified several predictors including the Medical College Admission Test (MCAT), the authors stated that there was still a need for more research. While scores on the MCAT and undergraduate academic performance have been shown to be related to grades on the United States Medical Licensing Examination (USMLE), there is still a need for better predictors to improve the selection process (Miller-Matero et al., 2018). The focus of this research was on grit which was hypothesized as a trait that would be prevalent in medical school students. Eligible participants were recruited from a group of graduating medical students (n = 309). Duckworth's 12 item grit survey was completed by 130 of the eligible medical students. The participants' grit scores were between 3.08 and 4.92. The mean score was 4.01 with a standard deviation of 0.42. Grit scores were higher for students who completed medical school in 4 years compared to those who completed in 5 years (Miller-Matero et al., 2018). The class was ranked based on both academic and clinical performance. Students with the highest academic and clinical scores were classified as exceptional. Those students at the bottom of this scale were classified as

good. Students who were classified as exceptional scored higher in grit than students who were classified as good (Miller-Matero et al., 2018).

The original grit measurement tool was a 12-item self-report instrument divided into a two-factor structure. According to Duckworth (2007), grit is composed of two dimensions, interest, and effort. Because the predictive ability of each dimension was never explored, another study was conducted to see if either dimension predicted outcomes better than the other (Duckworth & Quinn, 2009). In addition, this study was also focused on validating a more efficient grit scale and was divided into six separate parts to identify which items on the original grit scale (Grit-O) were better at predicting outcomes. The resulting short Grit Scale (Grit-S) was tested for validity, stability, and predictive outcomes. The results of this study validated the new 8-item Grit-S instrument as a more efficient instrument to measure perseverance and passion for long-term goals (Duckworth & Quinn, 2009).

In a recent study that focused on the role of grit and social capital in first-generation college student success, Almeida et al. (2021) found that the two components of grit which are consistency of interest and perseverance of effort did not predict first-generation college student grade point average. The analysis of data collected by an online survey sent to first-generation juniors and seniors found that grit is less influential than social capital in predicting academic success in first-generation college students. In addition, the separate components of grit, consistency of interest (CI) and perseverance of effort (PE), did not separately predict the cumulative GPA of first-generation college students. However, access to social capital was able to predict first-generation college student cumulative GPA. According to social capital theory, students with access to resources, information, and support from their social connections are more academically successful than students who lack these connections (Almeida et al., 2021). Although social capital

was more predictive of GPA than grit in this study, grit was not discounted entirely due to several findings. For example, students who were higher in grit tended to work longer hours at part-time jobs which may partially explain why they had lower GPA's. They also found that students with higher grit scores also had more connections, larger networks, and were more likely to go to faculty and staff members for career advice. The researchers concluded that grittier students use grit to succeed in college by using resources to help them navigate and overcome obstacles that they inevitably encounter in higher education. Recommendations included encouraging grit by engaging students' interests, developing knowledge of networks and resources within those networks, and designing social spaces to facilitate the development of social capital (Almeida et al., 2021). Another recent study by Caporale-Berkowitz et al. (2022) focused on the relationship between resilience, grit, and student retention following academic probation. The researchers looked at a large sample of undergraduates from multiple institutions to see how grit and resilience predicted retention between Fall 2015 and Fall 2016. The two components of grit were analyzed separately. Grit-PE measures perseverance of effort and Grit-CI measures consistency of interest. When analyzing data for the entire sample (N = 4023), Grit-PE (perseverance of effort) predicted Fall 2016 enrollment, but when students with a history of probation were compared to students without a history of probation, only resilience predicted Fall 2016 enrollment. Grit-PE only predicted Fall 2016 enrollment in the group of students without a history of probation. Grit-CI (consistency of interest) was not predictive for either group. The researchers concluded that resilience is more predictive for college retention in students who are struggling and at high risk of dropping out.

Another noncognitive trait that has received significant attention is known as growth mindset. Like grit, there has been considerable research on the relationship between growth

mindset and general academic success and persistence, but there has been no research on the relationship between growth mindset and success in a collegiate professional pilot program. The following review is focused on research that sought to understand the effect of growth mindset on academic achievement.

The Relationship Between Growth Mindset and Persistence in Higher Education

In her book *Mindset: The New Psychology of Success,* Carol S. Dweck, Ph.D. described how she became interested in how different people cope with failure (Dweck, 2016). Her early research involved observing how students approached difficult problems in the form of puzzles. The first puzzles were relatively easy, but subsequent puzzles were progressively more difficult to solve. While observing the students struggling to solve the difficult puzzles, she noticed that some of the students were excited when faced with the difficult puzzles. They did not get discouraged by the possibility of failure. In fact, they didn't think they were failing at all. They viewed the difficult puzzles as an opportunity to learn (Dweck, 2016). In another study, she gave four-year-olds a choice to redo an easy puzzle or try a more difficult one. She found that the children who had a fixed mindset chose to redo the easy puzzle. They stuck to the safe choice because they said kids who are born smart "don't do mistakes" (Dweck, 2016 p.16). In other words, they thought that being smart was a fixed trait. The children with a growth mindset thought that the easy puzzle was a strange choice. These children thought that it was possible to get smarter and chose to do the more difficult puzzle. In fact, one of the children with a growth mindset said that she was "dying to figure them out" (Dweck, 2016 p. 17). Another study involved students who were just entering junior high school. The students answered questionnaires designed to measure their mindsets and then were followed for two years. The transition to junior high school is a difficult time for many students. As a result, many students experience declining grades but not all. The

students who scored high in growth mindset experienced an increase in their grades (Dweck, 2016).

Research by Claro et al. (2016) focused on structural factors that influence academic achievement such as socio-economic background and student beliefs about their intelligence. Growth mindset is the belief that intelligence can be developed and is not fixed (Dweck, 2016). Although socioeconomic background has been demonstrated to be one of the most reliable predictors of academic achievement, students from the same socioeconomic background often vary in academic achievement. Claro et al. (2016) sought answers to the following questions:

> What is the relationship between mindset and socioeconomic background? Is the relationship between mindset and academic achievement a lawful pattern that can be observed reliably across an entire nation, and is it strong enough to be practically meaningful when measured against canonical structural factors like family income? Is there evidence that economic disadvantage reinforced the fixed mindset? Finally, is a fixed mindset even more deleterious to economically disadvantaged students because they must overcome greater obstacles to succeed? (p.1)

To answer these questions, the authors analyzed data from the Chilean Government standardized tests of 10th grade students' mathematics and language skills. In addition, students and their families were also asked to complete a survey in 2012 which included a short version of Carol Dweck's standard instrument that measures student beliefs about the nature of intelligence. Their analysis demonstrated a strong relationship between students' mindsets and academic achievement, and this was true across all socio-economic backgrounds (Claro et al., 2016). They also found a relationship between mindset and economic disadvantages for the first time. Low-income Chilean students were two times as likely to exhibit a fixed mindset than Chilean students from the highest socio-economic backgrounds (Claro et al., 2016). Although the authors stated that this finding could not explain why disadvantaged students were more likely to have a fixed

mindset, the results suggested that economic disadvantage may lead to poor academic achievement by leading low-income students to believe that they cannot improve their intelligence. This finding was also consistent with previous research which found that a growth mindset is more beneficial for students who must overcome socio-economic barriers to succeed (Claro et al., 2016).

The growth mindset theory is not without some controversy. Yeager and Dweck (2020) sought to address questions that have been raised about growth mindset in an article published in American Psychologist. The authors were focused on addressing different controversies concerning growth mindset and emphasized that controversies are good because they can lead to theoretical advances and useful lessons (Yeager & Dweck, 2020). The controversy stems from studies that have not been able to replicate results concerning the power of growth mindset to predict outcomes and the effects of student and teacher mindset interventions. The article sought to answer the following questions: Do mindsets predict student outcomes? Do student mindset interventions work? Are mindset intervention effect sizes too small to be interesting? Do teacher mindset interventions work? Yeager and Dweck (2020) reviewed several different studies to answer these questions and concluded that there is more to learn about effect sizes in educational field experiments and designing standardized interventions. In addition, the authors felt that there was evidence that explains the heterogeneity of effects, and learning about the students and contexts of the studies that did not demonstrate the predicted outcomes can help improve the measurement of mindsets and interventions (Yeager & Dweck, 2020).

In addition to looking at grit and growth mindset separately, the following research has focused on how grit and growth mindset interact to influence academic success and persistence in higher education. In addition, this research sought to understand how grit and growth mindset influence each other.

The Interaction of Grit, Growth Mindset, and Persistence in Higher Education

Research by Park et al. (2020) focused on how grit and growth mindset interact and influence individuals during adolescence. Park et al. (2020) focused their research on the attributes of grit and growth mindset in adolescents because cultivating positive attributes is critical during this phase of development. Although the research on grit and growth mindset has developed independently, growth mindset is like grit because they both make important contributions to cognitive and behavioral outcomes (Park et al., 2020). Angela Duckworth even suggested that developing a growth mindset may lead to an increase in grit (Duckworth, 2016). In other words, individuals who believe in the ability to improve their intelligence are more likely to pursue long-term goals. Research has also shown that the opposite may be true; Increased grit may lead to an increase in growth mindset because someone who is high in grit will engage in deliberate practice to reach long-term goals (Park et al., 2020). Both grit and growth mindset were measured periodically to determine how grit and growth mindset are related and whether grit can predict growth mindset in the future. The methodology included autoregressive cross-lagged models to determine whether grit can predict growth mindset. The research sample included 1,667 eighth grade students from four different states who were recruited for another longitudinal study on character in adolescence. In addition, 145 teachers participated in the study to rate the students which allowed correlation between student and teacher ratings (Park et al., 2020).

The results confirmed that grit and growth mindset were both able to predict each other's future development. This finding was consistent within four different testing sessions. In addition, this pattern did not vary by socioeconomic status, ethnicity, or gender (Park et al., 2020). The analysis also found that grit was two times more predictive for growth mindset than growth mindset was for grit. These findings were consistent with clinical research findings that suggested

changes in behavior have a significant effect on cognitive changes. Although the analysis demonstrated a positive correlation between grit and growth mindset, the authors cautioned that correlation does not infer causation (Park et al., 2020).

Future research recommendations included a study to determine whether the passion component or the perseverance component of grit is most responsible for the results of this study. Previous research has suggested that the perseverance component is more predictive. Therefore, the authors concluded that it is possible the perseverance component of grit is what led to the results of this study (Park et al., 2020).

A study by Zhang et al. (2022) attempted to replicate the study by Park et al. (2020) to extend the findings to a younger population in China. Their research included two longitudinal studies of two large samples of Chinese elementary children over two years. The authors noted that most prior research on grit and growth mindset was conducted in the United States (Zhang et al., 2022). Therefore, this study focused on a population other than Western, educated, industrial, rich, and democratic (WEIRD) populations to establish external validity of the findings. The total population included over 5,000 Chinese elementary students who were asked to complete grit and growth mindset surveys five times over the course of two years. The results of these two large longitudinal studies were compared to the results of Park et al. (2020). The results both replicated and extended the results of Park et al. (2020). Zhang et al. (2022) found that rank-order changes in growth mindset were predicted by grit and small rank-order changes in grit were predicted by growth mindset. Although these results were thought to be counterintuitive, the authors cited research by Bandura (1967) that demonstrated how changes in behavior can lead to changes in beliefs. Zhang et al. (2022) concluded that success through sustained effort and passion for long-

term goals (grit) can also lead to the belief that intelligence and ability are not fixed (growth mindset).

Low rates of retention in online college and university programs may be due to a lack of grit and growth mindset according to a paper published by Hochanadel and Finamore (2015) in the Journal of International Education Research. The stated purpose of the paper was to examine existing research on academic persistence with a focus on grit and growth mindset to make recommendations to improve the retention rate in online higher education (Hochanadel & Finamore, 2015). Research cited in this paper included studies by Angela Duckworth (2016) on grit which explored educational persistence from a motivational and psychological perspective rather than traditional intelligence test scores. Research by Duckworth (2016) confirmed that grit was a reliable predictor of academic success and persistence.

Research by Carol Dweck of Stanford University was also cited by Hochanadel and Finamore (2015). Research by Dweck (2016) focused on how a belief that intelligence is fixed and cannot be improved may lead to poor academic performance and persistence. Alternatively, individuals who believe that intelligence is not fixed and can be developed through effort have a growth mindset and are more likely to succeed and persist academically. Dweck (2010) tested her theory with seventh grade students who were randomly assigned to two groups. One group (the control group) attended a workshop that taught study skills, and the other group (the treatment group) was taught both study skills and received training in growth mindset. The treatment group learned that the brain is like muscles that become stronger with exercise. In addition, they were taught that their brains formed new connections every time they learned something new which made them smarter over time. The results demonstrated a significant improvement in the treatment group's grades while the control group's grades continued to decline (Dweck, 2010). Growth

mindset and grit are similar according to Duckworth (2016) because they both contribute to positive cognitive and behavioral outcomes. Hochanadel and Finamore (2015) concluded that teachers should not just focus on students' grades, but they should also teach students how grit and growth mindset can help them improve their academic performance and persistence.

Conclusion

Recent research has demonstrated a strong relationship between grit, growth mindset and persistence in different academic environments, but there has been no research focused on how grit and growth mindset contribute to success in a collegiate professional pilot program. The goal of this research was to determine whether students who enroll and persist in a collegiate professional pilot program differ in grit and growth mindset from students who enroll in a collegiate professional pilot program but do not persist to graduation. In addition, this research investigated the differences between these two groups of students in their personal and educational experiences. If grit and growth mindset are related to persistence in a collegiate professional pilot program and can be cultivated in prospective student pilots, it may help reduce the number of students who drop out of collegiate professional pilot programs. It may also be helpful to understand the different experiences of students who initially enrolled and eventually graduated in a collegiate professional pilot program versus those who dropped out to pursue another concentration.

CHAPTER III: METHODOLOGY

Although there is plentiful research on the topic of college student success and persistence, much of the early research focused on cognitive skills and abilities as measured by standardized test scores and grade point averages. There is a growing body of knowledge concerning the effect of non-cognitive skills which are also known as soft skills such as motivation, integrity, and interpersonal communication (Wong & Chapman, 2022). This study focused on the non-cognitive traits known as grit and growth mindset.

Restatement of Problem and Research Questions

The attrition rate for first year collegiate professional pilot students is high which is not only a problem for the institutions that offer professional pilot degree programs, but it is also a problem for the commercial aviation industry. Due to several different factors such as the COVID-19 Pandemic and a recent surge in retirements, the airlines are facing a critical shortage of qualified commercial pilots. The success of the commercial aviation industry depends on the supply of qualified personnel. As a significant source of entry level pilots for the commercial aviation industry, it is important for collegiate aviation programs to identify traits and skills that can increase the number of students who successfully complete these programs to help resolve the shortage of qualified commercial pilots. Unfortunately, a high percentage of professional pilot students drop out before graduation. If this trend continues, it will be difficult for collegiate professional pilot programs to meet the airlines' need for qualified entry level commercial pilots. The ability to identify traits and skills that lead to successful completion of collegiate professional pilot programs will enable institutions to identify students who are more likely to be successful and design training programs that can

help students develop these helpful traits and skills. This research attempted to answer the following research questions:

1. Is there a difference in grit scores between students who enroll and persist in the professional pilot concentration and students who subsequently change to another concentration?
2. Is there a difference in growth mindset between students who enroll and persist in the professional pilot concentration and students who subsequently change to another concentration?
3. What are the differences between the personal and educational experiences of students who enroll and subsequently graduate in the professional pilot concentration and those who subsequently change to another aerospace concentration?

Research Design

This research study was focused on the relationship between the noncognitive traits of grit and growth mindset and success and persistence in a collegiate professional pilot program. The goal of this research was to determine whether students who enroll and persist in a collegiate professional pilot program differ in grit and growth mindset from students who enroll in a collegiate professional pilot program but do not persist to graduation. In addition, this research sought to understand the differences between these groups in their personal and educational experiences.

The design of this research was an explanatory sequential mixed-methods design which began with quantitative data collection and analysis. Then qualitative data was collected and analyzed to explain the quantitative results in more detail. The structure of this design is called

sequential because the initial quantitative phase was followed by the qualitative phase. Both quantitative and qualitative research methodologies have inherent strengths and weaknesses. The difference between these two methodologies is based on the type of data generated for analysis. Quantitative research methodologies are based on numerical data and qualitative research is based on nonnumerical data such as narratives and audiovisual materials. A mixed-methods study employs both methodologies to get a more holistic understanding of research results (Creswell & Creswell, 2023).

Mixed-methods research employs both quantitative and qualitative methods to overcome weaknesses and take advantage of the strengths of each methodology. Creswell and Creswell (2023) define mixed-methods research as:

> An approach to inquiry involving collecting both quantitative and qualitative data, combining (or integrating) the two forms of data, using a specific procedure or design, and drawing conclusions (meta inferences) about the insight to emerge from the combined databases. This description emphasizes a methods perspective focused on understanding mixed methods research from its data collection, data analysis, and interpretation. Also, in mixed methods a researcher brings philosophical assumptions and theories that inform the conduct of the research. (p.266)

According to Tashakkori and Teddlie (2003), the goal of every research project is to answer the questions formulated at the beginning of the project. The mixed methods research design should be adopted if it can answer these questions better than quantitative or qualitative research methodologies alone. Mixed methods research can also help evaluate the quality of the answers better than a single research design (Tashakkori & Teddlie, 2003).

The Initial quantitative analysis was conducted to answer the first two research questions. This was followed by an explanatory qualitative analysis to answer the third research question. In a review of mixed-methods research, Greene et al. (1989) identified five different purposes for

using a mixed-method design. Triangulation seeks corroboration with the results of the different research methods to increase the validity and counteract bias. Complementarity is focused on elaboration and clarification of the results of the other research method used in a mixed-methods study to increase meaningfulness and validity of the results. Development uses the results of one method to help develop or inform results of the other method to increase the validity of the results. Initiation looks for paradox and contradiction between the two research methods to increase the depth of the research results. Finally, expansion attempts to extend the range of the research by using different methods for different parts of the research (Greene et al., 1989). This research study fits the complementarity purpose because it seeks to elaborate and clarify the quantitative results in search of increased meaning and validity. Understanding mixed methods research requires an understanding of the differences between quantitative and qualitative research designs. The differences not only include the types of data collected, but also the philosophy behind each methodology as well as the procedures used for data collection, analysis, and interpretation.

Quantitative Design

The initial quantitative research design was a non-experimental, cross-sectional, descriptive study using surveys to determine the level of grit and growth mindset in two groups of students who major in Aerospace at Middle Tennessee State University. According to Creswell and Creswell (2023) quantitative research is defined as follows:

> Quantitative research is a means for testing objective theories by examining the relationship among variables. The researcher measures these variables using statistical procedures. The final written report has a set structure comprising the introduction, literature and theory, methods, results, and discussion. (p.267)

This study employed a nonexperimental quantitative design because the independent variables cannot be manipulated as required in an experimental quantitative design. The

independent variables in this study were grit and growth mindset which are preexisting traits that were measured with surveys. The dependent variable was success and persistence in a collegiate professional pilot program. Johnson and Christensen (2020) define nonexperimental research as "research in which the independent variable is not manipulated and there is no random assignment of participants to groups" (p. 623). In experimental research, an independent variable is manipulated and there is random assignment to groups. As a result, experimental research design provides stronger evidence for causality. Although the evidence for causality in nonexperimental research is not as strong as the evidence that is provided by experimental research, most educational research must be nonexperimental because it is impossible to manipulate most educational variables (Johnson & Christensen, 2020).

This quantitative nonexperimental research was also cross-sectional rather than longitudinal because the data was collected during a short period of time from the participants in the study. In longitudinal research, data is collected over time because the goal of longitudinal research is to make comparisons over time. The element of time is important when researchers are interested in how changes occur over time or when establishing cause and effect. The advantage of cross-sectional research is that data can be collected from participants in a short amount of time, but it is difficult to establish time order, and it is not possible to see changes in variables over time (Johnson & Christensen, 2020). However, we can partially determine time order in this study by understanding the nature of the independent variable. It was assumed that grit and growth mindset were preexisting traits in the students who participated in this study.

Another dimension of nonexperimental research is tied to the purpose of the research or the research objective. According to Johnson and Christensen (2020), the six major research objectives are explanation, influence, prediction, exploration, subjective understanding, and

description. The three objectives that are usually associated with nonexperimental research designs are explanatory, predictive, and descriptive. Explanatory nonexperimental research is focused on establishing cause and effect. Predictive nonexperimental research is focused on predicting a future outcome based on one or more independent variables. Descriptive nonexperimental research is concerned with accurately describing how a characteristic affects a population based on a sample. Descriptive research steps include randomly selecting a sample from a specific population, determining the characteristics of the sample, and inferring these characteristics to the population based on the sample (Johnson & Christensen, 2020). This study was descriptive because the purpose was to accurately describe the population of students who succeed and persist in a collegiate professional pilot program through the grit and growth mindset scores of a sample of these students.

Specific kinds of research problems are best addressed by quantitative research methodologies. According to Creswell and Creswell (2023), if a problem requires any of the following: "the identification of factors that influence an outcome, the utility of an intervention, or understanding the best predictors of outcomes," the quantitative research approach is best (Creswell & Creswell, 2023 p.21). The initial quantitative portion of this mixed methods research study sought to understand the effect of grit and mindset on success and persistence in a collegiate professional pilot program.

The survey measuring grit is the Grit-S Scale which was designed by Duckworth and Quinn (2009), and the survey measuring mindset is the Mindset survey designed by Dweck (2016). The Grit-S and Mindset instruments can be seen in Appendix A and are described in more detail later in Chapter III. These instruments were given to two groups of Aerospace students. One group consisted of Aerospace students who initially enrolled and stayed in the Professional Pilot

concentration. The second group consisted of Aerospace students who initially enrolled in the Professional Pilot concentration but eventually switched to another Aerospace concentration before graduation. Statistics were generated for each group with Microsoft Excel statistics software to determine if there is a difference in grit and growth mindset between the two groups. An a priori power analysis was completed with G*Power version 3.1.9.7 (Faul et al., 2007) to determine the minimum sample size. The required sample size to achieve a medium effect, with a significance criterion of $\alpha = .05$, was $N = 198$ for a two group, two independent means t test. Therefore, the obtained sample size of $N = 203$ was adequate to test the study hypothesis. The following hypotheses were tested in the initial quantitative phase of this mixed-methods research study.

Null Hypothesis 1: There is no difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Alternate Hypothesis 1: There is a difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Null Hypothesis 2: There is no difference in mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Alternate Hypothesis 2: There is a difference in mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Qualitative Design

The second phase of this explanatory sequential mixed-methods study was a general qualitative comparative analysis to answer the third research question concerning the difference in personal and educational experiences between students who enroll and persist in a collegiate professional pilot program and those who eventually switch to another Aerospace concentration. Creswell and Creswell (2023) define qualitative research as follows:

> Qualitative research is a means for exploring and understanding the meaning individuals or groups ascribe to a human or social problem. The process of research involves emerging questions and procedures, collecting data in the participants' setting, analyzing the data inductively to build from particulars to general themes, and making interpretations of the meaning of the data. The final written report has a flexible writing structure. (p.267)

Unlike quantitative research, which is based on numerical data, qualitative research is based on the collection of qualitative data which is nonnumerical data like words, pictures, video, and audio recordings. According to Johnson and Christensen (2020), quantitative research is a confirmatory method that is focused on hypothesis and theory testing. Quantitative research is based on determinism which is the belief that all human behavior can be determined by one or more causes. Alternatively, qualitative researchers believe that human behavior is characterized by constant change over time and place. Qualitative research is an exploratory method that is used by researchers who are focused on describing what is observed in the natural environment and not in a laboratory. In addition, qualitative research can be used to generate new theories and hypotheses and is commonly used to better understand individual experiences (Johnson & Christensen, 2020). Qualitative data collection is collected in the following manner: The researcher is the primary data collection instrument in qualitative research unlike quantitative research that employs instruments such as surveys to collect numerical data. The qualitative researcher collects

the data, interprets the data, and records observations (Creswell & Creswell, 2023). Collecting data may involve asking research participants open-ended questions to understand how they experience certain phenomena. Because of the researcher's role in qualitative research, it is important to include statements in the research report that disclose any connection between the researcher and the participants that may influence the research results. In addition, reflexivity requires researchers to reveal details of their background, experiences, and culture that may also cause potential bias (Creswell & Creswell, 2023).

Unlike quantitative data analysis which employs descriptive and inferential statistics to analyze numerical data, the qualitative researcher analyzes nonnumerical data by organizing it, coding it by labeling sections with a word or phrase that represents a category, and generating themes to analyze and develop a story line for interpretation (Creswell & Creswell, 2023). The second phase of this explanatory sequential mixed-methods research study employed interviews with open ended questions designed to better understand how the educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration compare to the educational experiences of those who subsequently change to another Aerospace concentration. The complete interview protocol can be seen in Appendix A and is be described in more detail later in Chapter III.

Mixed Methods Design

According to Tashakkori and Teddlie (2003), there are three areas that are best addressed by a mixed methods study:

1. Research questions that the other methodologies cannot answer can be answered by mixed methods research.

2. Better and stronger inferences are provided by mixed methods research results.
3. The results of mixed methods research can present a greater diversity of divergent views.

Although researchers have disagreed about the types of questions that can be answered by quantitative and qualitative research, most agree that quantitative research is usually confirmatory, and many quantitative research questions involve verification of theory. Alternatively, qualitative research is exploratory in nature and usually involves the generation of theory (Tashakkori & Teddlie, 2003). According to Johnson and Christensen (2020), strengths of mixed methods research include the ability to answer a range of research questions because the researcher is not limited by a single methodology. The beauty of mixed methods research is that it allows researchers to handle both types of questions in the same research study. An example is a research study that is focused on establishing a predictive relationship between two variables and simultaneously answering questions about how the relationship between the two variables occurs (Tashakkori & Teddlie, 2003).

Both quantitative and qualitative research methods have advantages and disadvantages, and researchers can capitalize on the advantages of both while compensating for each method's disadvantages by employing a mixed methods research study. According to Creswell and Creswell (2023), mixed methods research can combine the strengths of both quantitative and qualitative research and result in a better understanding of a research problem. For example, social science problems and phenomena are complex and require the use of different research methods to provide more depth of analysis resulting in stronger inferences. The inferences generated by mixed methods research are stronger and more accurate because the advantages of both quantitative and qualitative research methods can be maximized in the same study (Tashakkori & Teddlie, 2003).

The third area that Tashakkori and Teddlie (2003) said was best accomplished by mixed methods research was in the presentation of a greater diversity of divergent views. Early critics of mixed methods research correctly noted that the quantitative and qualitative results of a mixed methods research study could result in totally different determinations. However, advocates of mixed methods research do not consider the possibility of divergent findings to be a problem. In fact, diverse and divergent findings could lead to rethinking existing theories and assumptions. Divergent results could be a signal that the problem addressed is more complicated than was initially thought. The use of only a single research approach could limit the understanding of a phenomenon, and conflicting results in a mixed methods study may motivate researchers to collect more data or conduct new studies to determine why conflicting results were obtained (Johnson & Christensen, 2020).

The research questions addressed in this study fit nicely into the first two areas that are best addressed by a mixed methods study according to Tashakkori and Teddlie (2003). The first area of research best addressed by mixed methods are research questions that other methodologies cannot answer. Phase I of this study focused on quantitative data to see if students who enroll and persist in a collegiate professional pilot program and students who enroll in a professional pilot program but do not persist differ in the noncognitive traits known as grit and growth mindset. Phase II was a general qualitative comparative analysis with collection of qualitative data through interviews with a purposeful sample of students who participated in the first phase of the study. Although the initial quantitative phase of this study can tell us how grit and growth mindset scores are statistically related to success and persistence in a collegiate professional pilot program, it cannot tell us why this relationship exists. That was the focus of the second qualitative phase which

sought to understand the different personal and educational experiences that contribute to grit and growth mindset.

The second area of research best addressed by mixed methods according to Tashakkori and Teddlie (2003) is research that seeks better and stronger inferences. Quantitative research can tell us that the independent variables of grit and growth mindset are related to success and persistence in a collegiate professional pilot program, but qualitative research can reveal the reasons for the relationship. Qualitative interview data can provide better and stronger inferences about how grit and growth mindset is developed and how it contributes to success and persistence in a collegiate professional pilot program.

The initial quantitative phase of this explanatory sequential mixed methods research study was focused on the noncognitive traits of grit and growth mindset and how these noncognitive traits differ in students who enroll and persist in a collegiate professional pilot program from those who enroll in a collegiate professional pilot program but graduate in another concentration. Participants completed Angela Duckworth's Grit-S instrument (Duckworth & Quinn, 2009), and Carol Dweck's mindset survey (Dweck, 2016) to determine their grit and growth mindset scores. Then a statistical analysis was performed on the scores to see if there is a difference between the two groups of students. The second qualitative phase of this mixed methods study included structured interviews of a purposeful sample of students from each group to determine if there is a difference in the personal and educational experiences between the two groups.

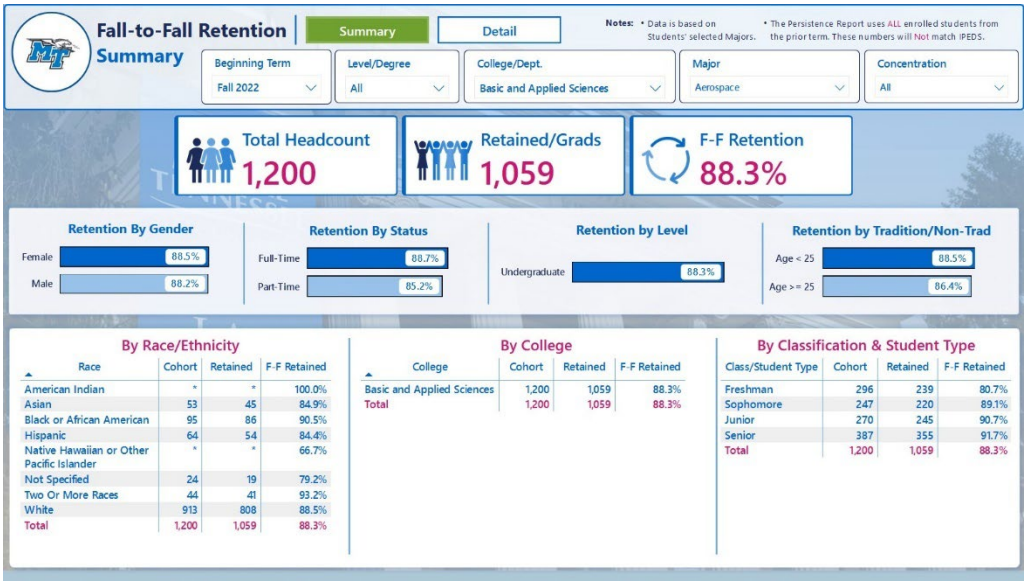
Population and Sample

Participants in the first phase of this study were junior and senior Aerospace students at Middle Tennessee State University (MTSU). Two groups were recruited from upper-level Aerospace courses in all concentrations to complete the Grit-S and growth mindset instruments. The first group consisted of Aerospace students in the Professional Pilot concentration, and the second group consisted of Aerospace students enrolled in one of the four other Aerospace concentrations. The total population of Aerospace students at MTSU in 2022 is depicted in Figure 3 below. There were 1,200 students enrolled in Aerospace concentrations in the Fall 2022 semester. Fall to fall retention beginning Fall 2022 for all Aerospace concentrations was 88.3%. One hundred forty-one Aerospace students did not return for the Fall 2023 semester (See Figure 4).

Of the 141 Aerospace students who did not return for the Fall 2023 semester, 111 were enrolled in the Professional Pilot concentration (See Figure 4). Although the retention rate for Professional Pilot students has been as low as 80.2% in 2013 and as high as 89.8% in 2017, there were 764 students who initially enrolled in the Professional Pilot concentration and did not return the following Fall semester since 2013 (See Figure 5). Research by Beckman and Barber (2007) found that many of the students who initially enrolled in the Professional Pilot concentration did not drop out of the university and did not switch to another college or major field of study. Many of the students who did not return to the Professional Pilot concentration switched to one of the other Aerospace concentrations. These students along with students who initially enrolled and persisted in the Professional Pilot concentration were recruited for this mixed methods research study.

Figure 3

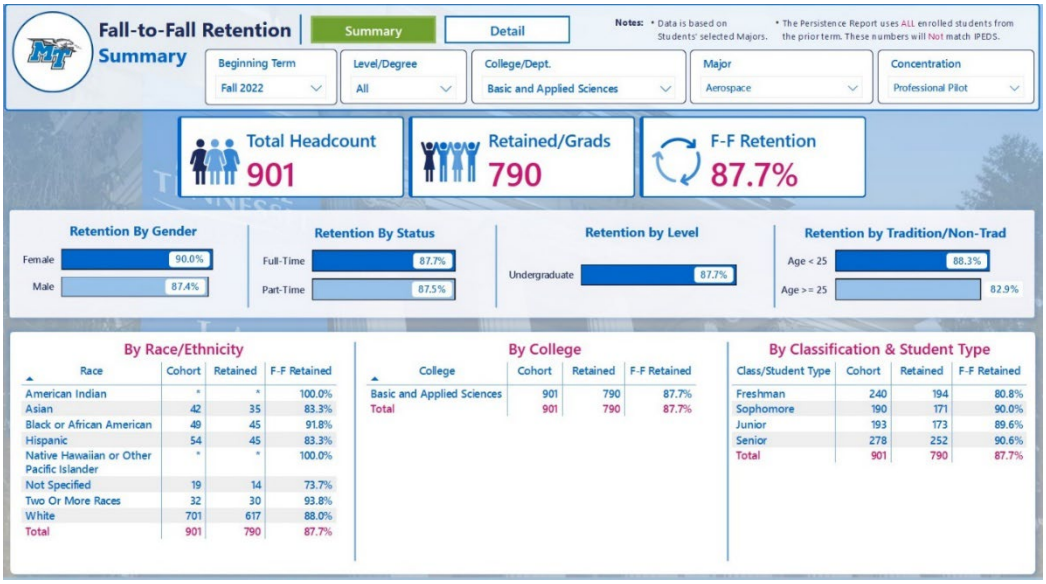
Fall to Fall Retention All Aerospace Concentrations Beginning Fall 2022



(Middle Tennessee State University, 2024b)

Figure 4

Fall to Fall Retention Professional Pilot concentration Beginning Fall 2022



(Middle Tennessee State University, 2024b)

Figure 5

Fall to Fall Retention Professional Pilot concentration Over Time

(Middle Tennessee State University, 2024b)

Instrumentation

Grit-S Instrument

Duckworth et al. (2007) defined grit as perseverance and passion for long-term goals. Several studies have demonstrated that grit can predict adult educational attainment, Ivy League undergraduate grade point average, retention in 2 different classes at the United States Military Academy at West Point, and National Spelling Bee contestant rankings. The concept of grit and its relationship with human performance came about through interviews with individuals in fields such as medicine, law, and academia. When asked about the qualities of high achievers in their fields, grit or some similar attribute was cited just as much as talent. Indeed, some noted that some high achievers who did not seem to be as talented as others succeeded through shear effort over time while many highly gifted individuals were not as successful (Duckworth et al., 2007). To

address the relationship between grit and success, Duckworth et al. (2007) developed a measurement tool that was valid for both children and adults involved in both professional and academic pursuits. The result was a 12-item survey they called the Grit Scale.

Duckworth and Quinn (2009) sought to design a shorter and more efficient grit measurement tool in six separate studies. These studies focused on identifying items on the original 12 item grit scale (Grit-O) with the highest predictive value across samples from previous studies. The result was the Grit-S instrument which consists of eight of the original 12 items on the Grit-O instrument (Duckworth & Quinn, 2009). The Grit-S instrument was found to be psychometrically stronger than the original Grit-O instrument. In addition, the Grit-S instrument fit the data from previous studies better than the Grit-O instrument and the reduction of items did not affect its predictive value. As a result, the authors recommended the Grit-S instrument as a more efficient measure of perseverance and passion for long-term goals. You can find the Grit-S instrument that was employed in this study in Appendix A.

Growth Mindset Instrument

Early in her research career, Carol S. Dweck, Ph.D. became interested in how people deal with failure. Her initial studies involved young students who were given several different puzzles to solve. The first puzzles were relatively easy to solve, but subsequent puzzles were more and more difficult. As she observed these young students work diligently to solve the more difficult puzzles, she noticed that some of them were excited about the more difficult puzzles and seemed to be energized by the challenge. Many of these students viewed failure as a chance to learn something new. This was the beginning of her interest in how a person's mindset can influence success or failure at school, at work, and in one's personal life (Dweck, 2016). The students who were excited by the challenge of a difficult task even if they failed at the task were not defeated by

failure. They looked at failure as a chance to learn and develop new knowledge and skills. It was as if they believed that they could improve their intelligence through effort. This experience caused Dweck (2016) to question her belief that human intelligence is a fixed quality. So began her research into the psychology of mindset.

Dweck defined fixed mindset as the belief that human intelligence is fixed and is impossible to improve. Alternatively, a growth mindset is the belief that human intelligence is malleable and can be increased through practice and training (Dweck, 2016). People who have a growth mindset are not afraid of failure. Indeed, growth mindset leads people to look at failure as an opportunity to learn. People with a fixed mindset believe that people are either smart of not, and a person who fails demonstrates a lack of intelligence. Avoiding failure becomes the end goal for people with a fixed mindset because they believe that people who fail are not smart. In her book *Mindset: The New Psychology of Success,* Dweck (2016) described a survey that was designed to reveal the extent to which someone has a fixed or a growth mindset. You can find the complete mindset survey used in this study in Appendix A.

Qualitative Interview Protocol

The final phase of this explanatory sequential mixed-methods research study was a general qualitative comparative analysis to answer the third research question about the personal and educational experiences of students who enroll and persist in a collegiate professional pilot program and those who eventually switch to another Aerospace concentration. According to Greene et al. (1989) there are five different purposes for using a mixed-method design. Complementarity is when one research method elaborates and clarifies the results of the other research method used in a mixed-methods study to increase the meaningfulness and validity of the results. Because the qualitative phase of this explanatory sequential mixed-methods study sought

to elaborate and clarify the initial quantitative results in search of increased meaning and validity, the purpose of the second qualitative phase of this study was complementarity.

Qualitative data was collected through interviews with students who are Aerospace juniors and seniors enrolled in upper-level Aerospace courses at Middle Tennessee State University. The interviews took place remotely on Zoom and lasted approximately 30 minutes. These interviews were recorded and transcribed. After the recordings were transcribed, they were edited, and the recordings were destroyed. The edited transcriptions were then coded using dedoose software to discover themes as expressed by students who did not persist in the Professional Pilot concentration and students who did persist. These interviews were designed to answer the third research question: What is the difference between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? For example, students were asked to describe a time when they faced and overcame a setback to elaborate and clarify their grit scores. Also to elaborate and clarify their mindset scores, students were asked to describe a time when they agreed to do a long-term project or task that they thought would improve their knowledge and skill level. The complete interview protocol is included in Appendix A.

Validity and Reliability

Grit-S Instrument Validity and Reliability

Duckworth et al. (2007) demonstrated that grit or trait-level perseverance and passion for long-term goals can predict academic achievement more than talent or standardized test scores. In one example, West Point cadets who were higher in grit were more likely to persist than cadets who were lower in grit. This was true even when controlling for SAT scores. The original 12-item

Grit-O instrument was designed with a two-factor structure which was consistent with the theory that grit is a combination of interest and effort (Duckworth & Quinn, 2009). Because the validity of these two factors was never verified, Duckworth and Quinn (2009) sought to validate a shorter and more efficient grit scale with four samples that were in the earlier study by Duckworth et al. (2007). The result was the 8-item Grit-S instrument. Duckworth and Quinn (2009) analyzed the Grit-S instrument's two-factor structure of interest and effort and found that they were distinctive and able to predict success in different arenas. For example, Perseverance of effort was best at predicting GPA and extracurricular activities, and consistency of interest was best at predicting the number of career changes in adults. However, the combined total Grit-S score was found to be superior over each factor alone in predicting National Spelling Bee finalists and retention of West Point cadets. Although this supported the theory that grit is a compound trait, the authors concluded that the predictive validity of the Grit-S instrument was due to its exceptional reliability. To verify the reliability of the Grit-S instrument, Chronbach's Alpha was calculated.

Mindset Instrument Validity and Reliability

According to Yeager and Dweck (2020), there has been a growing emphasis on replication and generalizability of growth mindset research results that has resulted in several controversies. Questions have been asked about when, why, and under what circumstances can growth mindset interventions be effective. Some research has failed to replicate the association between growth mindset and achievement. Due to increasing interest in metascience and testing of heterogeneity of effects, questions have been raised about the replicability and generalizability of mindset research findings (Yeager & Dweck, 2020). Consequently, the ability of mindsets to actually predict student outcomes has been called into question. Mindsets are measured by asking research participants about their level of agreement or disagreement with statements such as "You can learn

new things, but you can't really change how intelligent you are" (Dweck, 2016). Agreement with this statement corresponds to a fixed mindset, and disagreement corresponds to a growth mindset. The typical mindset survey includes four statements that are designed in the direction of a fixed mindset and four statements that are designed in the direction of a growth mindset. There have been larged scale studies that have been supportive of the predictions of mindset theory while other studies have not been supportive. Studies that have not supported the predictions of mindset theory were conducted in China and the Czech Republic. Yeager and Dweck (2020) concluded that there will always be unexplained differences between cultures and that many large scale studies have supported the replication and generalizability of the association between mindset and achievement. The evidence reviewed in this study supported the soundness of the mindset survey instrument. However, Chronbach's Alpha was calculated to verify its reliability.

Qualitative Comparative Analysis Validity and Reliability

According to Creswell and Creswell (2023), researchers must validate the results of a qualitative study by describing the steps that will be taken to verify the accuracy and credibility of their research findings. Validity in qualitative research differs from validity in a quantitative research study.

In quantitative research, numerical data is valid if accurate conclusions can be made based on the instrument used to collect data in the study (Creswell & Creswell, 2023). In qualitative research, validity refers to the procedures used by the researcher to check the accuracy of the findings such as triangulation which is using different types of data sources or member checking which is verifying the accuracy of findings by asking participants to review the final report and asking them for feedback. Disclosing researcher bias or reflexivity is another way to validate qualitative research findings (Creswell & Creswell, 2023). To ensure validity of this general

qualitative comparative analysis, a combination of strategies were employed including reflexivity, member checking, and the use of an external auditor to review the research for an objective assessment.

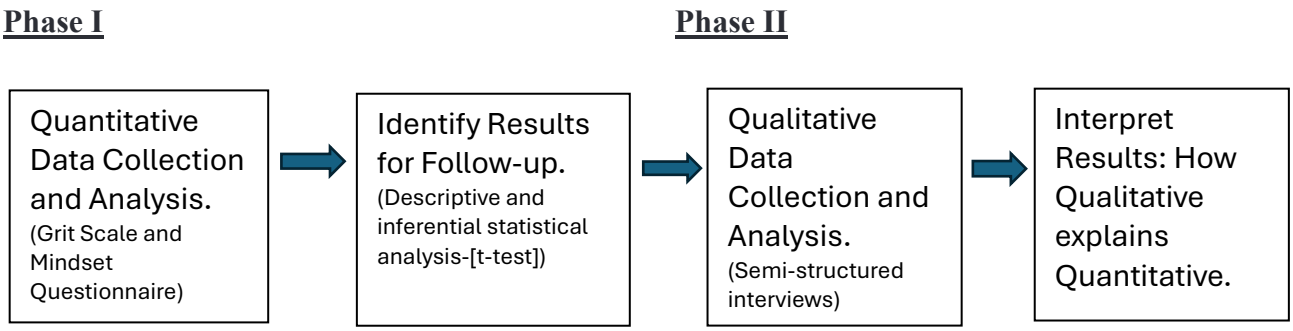
Reliability of quantitative research findings refers to the ability of the data collection instrument to obtain consistent and repeatable results. Qualitative research findings are considered to be reliable if the researcher carefully documents each step of the research project procedures so that other researchers are able to follow the same procedures and replicate the study (Creswell & Creswell, 2023). To ensure the reliability of this general qualitative comparative analysis in phase II of this mixed methods study, each step and procedure is explained in detail including instrumentation, data collection, and data analysis.

Data Collection Procedures

Phase I of this explanatory sequential mixed methods study focused on the collection and analysis of quantitative data. This quantitative data are in the form of participant scores on the Grit-S and Mindset instruments which was administered online through Qualtrics. Based on their Grit-S scores, the participants were placed in one of three groups: low grit, moderate grit, or high grit. Mindset scores determined where a participant falls on a continuum between a fixed mindset and a growth mindset. After Phase I was completed, Phase II focused on collecting and analyzing qualitative data obtained through semi-structured interviews with a purposeful sample of Phase I participants. Phase II qualitative data was analyzed to explain and clarify the results of the Phase I quantitative data analysis. Figure 6 depicts a flowchart of this explanatory sequential mixed-methods research study.

Figure 6

Flowchart of Explanatory Sequential Mixed Methods Study



Quantitative Data Collection Procedures

Aerospace students were asked to complete the Grit-S and Mindset instruments. Recruitment of participants was done through email and social media. Recruitment posters were placed strategically around campus, and in-person recruitment was conducted in upper level Aerospace classrooms. These instruments were created and administered on Qualtrics, and a QR code and link to the instruments were provided on all recruitment materials. The Grit-S and Mindset instruments each contain eight items and take no more than 15 minutes to complete. In addition to the Grit-S and Mindset instruments, participants were asked to complete a short survey to determine their class standing, initial Aerospace concentration, and Aerospace concentration in which they expect to graduate. The final question on the survey asked participants if they were willing to volunteer for Phase II of this research study, and if so, they were asked to provide contact information. These instruments can be seen in Appendix A.

Qualitative Data Collection Procedures

Phase II of this mixed methods research study was a general qualitative comparative analysis to clarify and explain the results of the Phase I quanitative results. Qualitative data collection was accomplished through semi-structured interviews with a purposeful sample of participants who previously completed the Grit-S and Mindset instruments and met the criteria for the purposeful sample. A purposeful sample is one that will help understand the research problem (Creswell & Creswell, 2023). Selecting a purposeful sample involves defining characteristics of participants who will help answer the research questions and shed light on the research problem to be studied. Purposeful sampling is also called criterion-based selection because criterion are developed by the researcher to select participants who will help answer the research question(s) (Johnson & Christensen, 2020). After these characteristics were identified, participants with the desired qualities were recruited to participate in semi-structured interviews designed to explain and clarify the Phase I quantitative results of this explanatory sequential mixed methods research study.

According to Johnson and Christensen (2020), a qualitative interview is designed with open-ended questions. It is important for a researcher to show understanding and empathy to make the participant feel comfortable revealing information about his or her thoughts, beliefs, and feelings about the research topic (Johnson & Christensen, 2020). Interview questions should be open ended to elicit as much information as possible. Questions that can be answered with a simple yes or no should be avoided. An interview protocol was used to conduct all interviews. The interview protocol included background information about the research study, introduction, interview questions, probes, and a closing paragraph with a debrief. The complete interview protocol can be seem in Appendix A. Interviews were done remotely on Zoom and recorded with

the permission of the participant. The video recording was uploaded to Adobe Premier Pro to protect the participants' confidentiality. Uploading the video to Adobe Premier Pro also allowed automated transcription of the interview.

Data Analysis Procedures

Two groups of Aerospace students at Middle Tennessee State University were recruited to answer Angela Duckworth's Grit-S survey and Carol Dweck's Growth Mindset survey. Grit and growth mindset scores were calculated for participants in each group. Descriptive statistics and a two-sample t test assuming unequal variances were generated with Microsoft Excel statistical software to determine the difference in mean grit and growth mindset scores between the two groups of participants. The first group consisted of Aerospace students who answered that they initially enrolled and intended to graduate in the Professional Pilot concentration. The second group consisted of Aerospace students who answered that they switched to another Aerospace concentration after initially enrolling in the Professional Pilot concentration. Grit and mindset scores were calculated as described in the next two sections.

Grit-S Instrument Scoring

The eight-item Grit-S instrument maintains the same two-factor structure as the original twelve-item Grit-O instrument which describes grit as a compound trait comprised of passion and perseverance. Half of the questions concern passion and the other half concern perseverance for long-term goals. Scoring the Grit-S instrument is done as follows:

For perseverance questions 2, 4, 7 and 8 assign the following points:

5 = Very much like me
4 = Mostly like me
3 = Somewhat like me
2 = Not much like me
1 = Not like me at all

For passion questions 1, 3, 5 and 6 assign the following points:

1 = Very much like me
2 = Mostly like me
3 = Somewhat like me
4 = Not much like me
5 = Not like me at all

Add up all the points and divide by 8. The maximum score on this instrument is 5 (extremely gritty), and the lowest score on this instrument is 1 (not at all gritty).

Mindset Survey Scoring

Dweck (2016) designed a mindset survey with eight statements. Individuals are asked to select one of four choices after each statement: strongly disagree, disagree, agree, and strongly agree. Each choice is scored as shown on the Mindset Questionnaire which can be seen in Appendix A. Statements 1 through 4 concern beliefs about intelligence. Statements 1 and 2 refer to a fixed mindset and statements 3 and 4 refer to a growth mindset. Statements 5 through 8 concern beliefs about personal abilities. Statements 5 and 6 refer to a fixed mindset, and statements 7 and 8 refer to a growth mindset. The mindset of the individual who completed the survey was scored as follows:

- 4 – 6 = Strong fixed mindset
- 7 – 10 = Fixed mindset with some growth ideas
- 10 – 13 = Growth mindset with some fixed ideas
- 14 – 16 = Strong growth mindset

Quantitative Data Analysis

Descriptive statistics and a t-test were generated to see if there is a significant difference in grit and mindset scores for Aerospace students who indicated that they initially enrolled and intend to graduate in the Professional Pilot concentration and Aerospace students who indicated that they initially enrolled in the Professional Pilot concentration and subsequently switched to one of the other four Aerospace concentrations.

Qualitative Data Analysis

Automatic transcripts from Adobe Premiere Pro were edited in the first round of qualitative data analysis. Once the transcripts were edited, the data was segmented. According to Johnson and Christensen (2020), "segmenting involves dividing up the data into meaningful analytical units. (p. 544) Meaningful units can be a sentence, a paragraph, or a single word. When searching for segments, researchers should look for text that has meaning important to the research study (Johnson & Christensen, 2020).

After the data was segmented, the segments were coded. Creswell and Creswell (2023) define coding as "the qualitative data analysis process of organizing material into chunks or segments of text and assigning a word or phrase to the segment to develop a general sense of it." (p. 263) Coding is simply assigning a category or name to a segment of data. While coding the segments, a master list of codes was developed. In addition to each code, the master code list should include a definition for each code. The master code list not only helped keep the codes organized, but it also will allow other researchers to use the list when attempting to replicate the study (Johnson & Christensen, 2020). The codes describe the different segments of data, but the codes are conceptual rather than literal so that they can be applied to multiple segments of data.

The codes were inductive rather than a priori. In other words, the codes were generated directly from the segmented data. A priori codes are generated before the start of the research. There may be segments that were assigned two or more different codes. These are called co-occurring codes and may signify that multiple codes have similar meanings (Johnson & Christensen, 2020). Concept codes were assigned to the segments of data in the first stage of coding. Saldana (2016) defined concept codes as follows.

> Concept codes assign meso or macro levels of meaning to data or to data analytic work in progress. A concept is a word or short phrase that symbolically represents a suggested meaning broader than a single item or action – a "bigger picture" beyond the tangible and apparent. A concept suggests an idea rather than an object or observable behavior. For example, a clock is something you can touch and see as it changes minute to minute, but its conceptual attribution is time. One can see and touch a church building, but not the concepts of spirituality or religion. (p. 119)

Once the transcripts were edited, segmented, and coded, first-stage coding was complete. Then second-stage coding was done to analyze the first-stage coding and make sense of it. Second-stage coding involves looking for themes and relationships between codes, themes, and catergories (Johnson & Christensen, 2020). Themes are codes and categories that appear frequently in qualitative data. In the second stage of coding, the data was analyzed for themes to make more sense of the data and answer the third research question: What is the difference between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? Table 3 below is a summary of the logic behind this research design.

Summary

In this chapter, the research problem and research questions were restated and followed by a detailed description of this explanatory sequential mixed methods study. In addition, the population and sample were described followed by a discussion of the instruments that were used

to collect quantitative and qualitative data. Next in this chapter was a discussion of validity and reliability of the instruments used to measure grit and mindset in the sample as well as a discussion of the steps taken to ensure validity and reliability of the general qualitative comparative analysis. Both quantitative and qualitative data collection procedures were described followed by a description of the quantitative and qualitative data analysis procedures that were used to answer the three research questions that this study addressed.

Table 3

Logic of Research Design

Research Question	Source of Information	Data Analysis Procedures
RQ 1: Is there a difference in grit scores between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?	Grit-S Scale Scores	Descriptive statistics and two sample t-test
RQ 2: Is there a difference in growth mindset between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?	Mindset Survey	Descriptive statistics and two sample t-test
RQ 3: What are the differences between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration?	Semi-structured interviews	Segmenting, coding, and thematic analysis

CHAPTER IV: RESULTS

Introduction

This chapter describes the results of the grit and growth mindset surveys in the first quantitative phase of this study as well as the findings from the semi-structured interviews with a purposeful sample of participants in the second qualitative phase. The purpose of the first quantitative phase of this study was to determine the difference in grit and growth mindset scores between students who enroll and eventually graduate in a collegiate professional pilot program and students who enroll in a collegiate professional pilot program but graduate in another concentration. The second qualitative phase aimed to provide clarification and explanation of the results of the first quantitative phase. The goal of this research was to provide important guidance and recommendations to help increase collegiate professional pilot student persistence and help alleviate the shortage of qualified commercial pilots. The following results of each phase of this explanatory sequential mixed-methods study are described separately.

Description of Phase 1 Participant Groups

In the first quantitative phase of this study, two groups of Aerospace students from Middle Tennessee State University were recruited to answer the Grit-S and Growth Mindset questionnaires. One of the groups who answered these questionnaires consisted of Aerospace students who initially enrolled and intended to graduate in the Professional Pilot concentration. The other group consisted of Aerospace students who switched to another Aerospace concentration after initially enrolling in the Professional Pilot concentration. A total of 250 Aerospace students answered the questionnaires. There were 47 incomplete questionnaires that were eliminated which left a total of 203 completed Grit-S and Growth Mindset questionnaires. There were 151 Aerospace

students out of 203 participants who answered that they had initially enrolled and intended to graduate in the Professional Pilot concentration. This group consisted of 67 seniors, 49 juniors, 29 sophomores, and 6 freshmen. The remaining 52 Aerospace students answered that they had initially enrolled in the Professional Pilot concentration but intended to graduate in another Aerospace concentration. This group consisted of 34 seniors, 12 juniors, 6 sophomores, and no freshmen.

Phase 1 Data Collection

Aerospace students were recruited in-person from upper level Aerospace classrooms to complete the Grit-S and Mindset instruments. Recruitment of participants was also accomplished through email and social media. In addition, recruitment posters were posted strategically around campus. All recruitment materials included a QR code and a link to the instruments.

The Grit-S and Mindset instruments were created and administered using Qualtrics. Each instrument consisted of eight items, and completion of both instruments took no more than 15 to 30 minutes. Participants were also asked to complete a short survey to determine their class standing, initial Aerospace concentration, and Aerospace concentration in which they expect to graduate. Finally, the survey asked participants if they were willing to volunteer for Phase II of this research study, and if so, they were asked to provide contact information. The Grit-S instrument, Mindset instrument, and short survey can be seen in Appendix A.

Scoring of the Grit-S Instrument

As described in Chapter III, scoring of the Grit-S Instrument is based on a two-factor structure comprised of passion and perseverance. Four of the 8 questions concern passion and the other 4 questions concern perseverance for long-term goals. Questions 2, 4, 7, and 8 concern the

perseverance component, and questions 1, 3, 5, and 6 concern the passion component. Answers are scored from 1 to 5 as shown in Table 4 and Table 5 below.

Table 4

For perseverance questions 2, 4, 7 and 8 assign the following points

Selection	Points
Very much like me	5 Points
Mostly like me	4 Points
Somewhat like me	3 Points
Not much like me	2 Points
Not like me at all	1 Point

Table 5

For passion questions 1, 3, 5 and 6 assign the following points

Selection	Points
Very much like me	1 Point
Mostly like me	2 Points
Somewhat like me	3 Points
Not much like me	4 Points
Not like me at all	5 Points

Overview of Grit-S Descriptive Statistics

See Table 6 below, which is a summary of the descriptive statistics for the Grit-S instrument results. On the left side of Table 6 are the descriptive statistics for Grit -S Group 1 which is the group of students who initially enrolled and intend to graduate in the Professional Pilot concentration. On the right side of Table 6 are the descriptive statistics for the Grit-S Group 2 which is the group of students who initially enrolled in the Professional Pilot concentration but

intend to graduate in another Aerospace concentration. On a scale of 1 to 5, the mean score for Grit-S Group 1 was 3.60513245 with a standard deviation of 0.526801021 and the mean score for Grit-S Group 2 was 3.408653846 with a standard deviation of 0.522247326. A score of 5 represents extremely gritty and a score of 1 represents not at all gritty.

Table 6

Descriptive Statistics for Grit-S Instrument

Grit 1		*Grit 2*	
Mean	3.60513245	Mean	3.408653846
Standard Error	0.042870459	Standard Error	0.072422674
Median	3.625	Median	3.5
Mode	3.5	Mode	3.75
Standard Deviation	0.526801021	Standard Deviation	0.522247326
Sample Variance	0.277519316	Sample Variance	0.27274227
Kurtosis	0.617839039	Kurtosis	0.161954729
Skewness	-0.478827863	Skewness	-0.142058984
Range	2.875	Range	2.375
Minimum	2	Minimum	2.375
Maximum	4.875	Maximum	4.75
Sum	544.375	Sum	177.25
Count	151	Count	52

Scoring of the Growth Mindset Instrument

The Growth Mindset instrument was designed to explore ideas about intelligence with questions 1 through 4 and about character with questions 5 through 8. A participant's score is calculated by adding all individual item scores within each subscale (intelligence and character). Questions 1 and 2 reflect a fixed mindset and items 3 and 4 reflect a growth mindset for the

intelligence subscale. Questions 5 and 7 reflect a fixed mindset and items 6 and 8 reflect a growth mindset for the character subscale. Total subscale scores range from fixed (4) to growth (16) mindset as described in Table 7 below.

Table 7

Total Mindset Subscale Scores and Interpretation

Score	Mindset
4 to 6 Points	Strong fixed mindset
7 to 10 Points	Fixed mindset with some growth ideas
10 to 13 Points	Growth mindset with some fixed ideas
14 to 16 Points	Strong growth mindset

(Dweck, 2016)

Overview of Growth Mindset Descriptive Statistics

See Table 8 and Table 9 below, which are summaries of the descriptive statistics for the growth mindset intelligence subscale and the growth mindset character subscale, respectively. On the left side of Table 8 are the descriptive statistics for the growth mindset intelligence subscale for Group 1 which is the group of students who initially enrolled and intend to graduate in the Professional Pilot concentration. On the right side of Table 8 are the descriptive statistics for the growth mindset intelligence subscale for Group 2 which is the group of students who initially enrolled in the Professional Pilot concentration but intend to graduate in another Aerospace concentration.

The mean score for the growth mindset intelligence subscale for Group 1 was 11.70198675 with a standard deviation of 2.328933095 and the mean score for the growth mindset intelligence

subscale for Group 2 was 12.21153846 with a standard deviation of 2.483960614. According to Table 7, both Group 1 and Group 2 exhibited a growth mindset with some fixed ideas on the intelligence subscale.

Table 8

Descriptive Statistics for Growth Mindset Intelligence Component

Growth Mindset Intelligence 1		Growth Mindset Intelligence 2	
Mean	11.70198675	Mean	12.21153846
Standard Error	0.189525887	Standard Error	0.34446336
Median	12	Median	12
Mode	12	Mode	12
Standard Deviation	2.328933095	Standard Deviation	2.483960614
Sample Variance	5.42392936	Sample Variance	6.170060332
Kurtosis	-0.163142224	Kurtosis	-0.330761364
Skewness	-0.419116848	Skewness	-0.531137772
Range	10	Range	10
Minimum	6	Minimum	6
Maximum	16	Maximum	16
Sum	1767	Sum	635
Count	151	Count	52

On the left side of Table 9 are the descriptive statistics for the growth mindset character subscale for Group 1. On the right side of Table 9 are the descriptive statistics for the Group 2 growth mindset character subscale.

The mean score for the growth mindset character subscale for Group 1 was 11.66887417 with a standard deviation of 1.798969536 and the mean score for the growth mindset character subscale for Group 2 was 11.76923077 with a standard deviation of 1.86416553. Again, according

to Table 7, both Group 1 and Group 2 exhibited a growth mindset with some fixed ideas on the character subscale.

Table 9

Descriptive Statistics for Growth Mindset Character Component

Growth Mindset Character 1		*Growth Mindset Character 2*	
Mean	11.66887417	Mean	11.76923077
Standard Error	0.146398065	Standard Error	0.258513246
Median	12	Median	12
Mode	12	Mode	12
Standard Deviation	1.798969536	Standard Deviation	1.86416553
Sample Variance	3.236291391	Sample Variance	3.475113122
Kurtosis	0.912296338	Kurtosis	-0.209497414
Skewness	-0.118701621	Skewness	0.38824342
Range	11	Range	8
Minimum	5	Minimum	8
Maximum	16	Maximum	16
Sum	1762	Sum	612
Count	151	Count	52

Overview of Grit-S Inferential Statistical Analysis

The first research question is noted below along with its corresponding hypotheses. Data obtained from the Grit-S questionnaire administered on Qualtrics was analyzed with a T-Test: Two-Sample Assuming Unequal Variances to determine if the difference in grit scores between the two groups of participants was significant.

The following research question was asked, and hypotheses were tested to determine whether grit can predict success in a collegiate professional pilot program:

Research Question 1. Is there a difference in grit scores between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?

Null Hypothesis 1: There is no difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Alternate Hypothesis 1: There is a difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Independent random samples of Middle Tennessee State University Aerospace students who initially enrolled in the Professional Pilot program were recruited to complete the Grit-S questionnaire through Qualtrics. Group 1 consisted of 151 students who enrolled in and intended to graduate from the Professional Pilot program. Group 2 consisted of 52 students who enrolled in the Professional Pilot program but intended to graduate in another Aerospace program.

A hypothesis test comparing two population means requires the following assumptions to be met. Refer to Table 6 to see the descriptive statistics for Grit Group 1 and 2.

1. Simple random samples
2. Independent samples

3. Normal populations or large samples
4. Equal population standard deviations

Checking the 4 conditions above required for using the T-Test to compare 2 population means:

1. The samples were simple random samples. Therefore, assumption 1 was satisfied.
2. The samples were independent. Therefore, assumption 2 was satisfied.
3. Normality was checked with probability plots (Figures 7 & 8). The samples were also very large (151 & 52). Therefore, assumption 3 was satisfied.
4. Levene's Test results of the sample variances for grit and both mindset subscales were greater than the .05 significance level. The sample variances were not significantly different.

Figure 7

Grit 1 Probability Plot

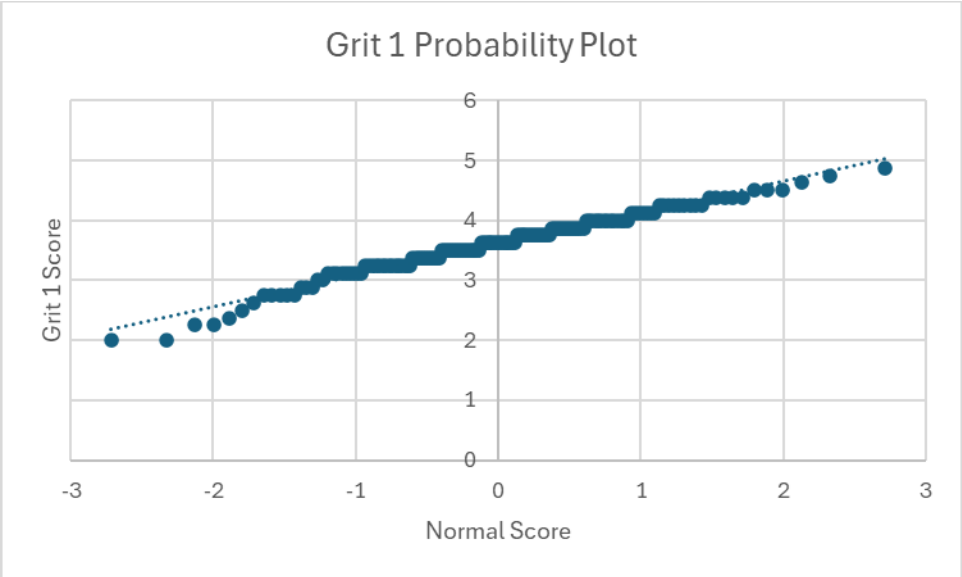
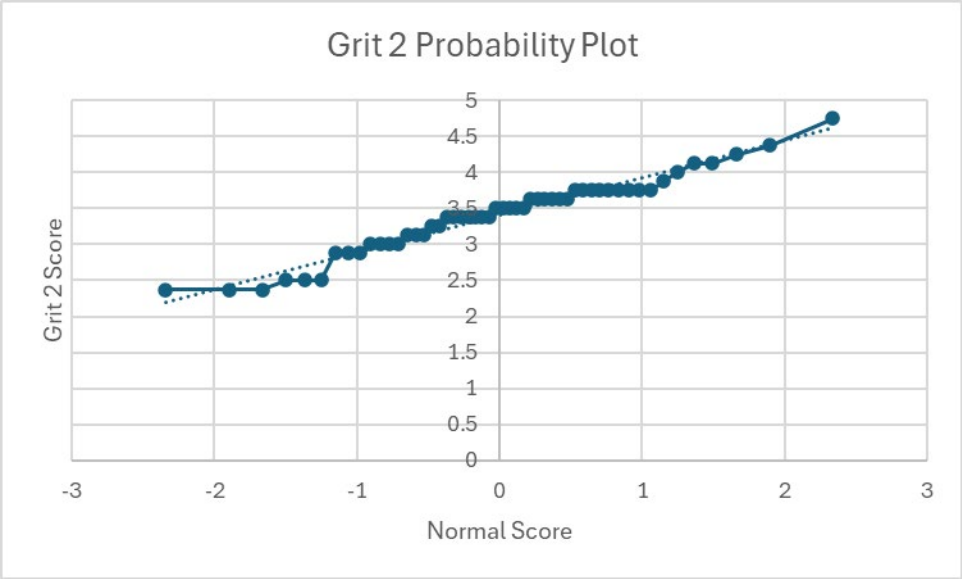


Figure 8

Grit 2 Probability Plot



A two-sample t-test was conducted comparing the mean scores of Grit Group 1 (mean = 3.60513245, SD = 0.526801021) and Grit Group 2 (mean = 3.408653846, SD = 0.522247326). See Table 10 for the results. The p-value in the two-tail t-test was less than 0.05. Therefore, there was a statistically significant difference between the mean scores of Grit Group 1 and Grit Group 2. The null hypothesis was therefore rejected, and we accepted the alternate hypothesis that states that there is a difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

The second research question and corresponding hypotheses are listed below. In addition to the Grit-S questionnaire, participants answered the Growth Mindset questionnaire on Qualtrics. This data was also analyzed using the T-Test: Two-Sample Assuming Unequal Variances to

determine if the difference in growth mindset scores between the two groups of participants was significant.

Table 10

t-Test: Two-Sample Assuming Unequal Variances

Grit

	Variable 1	*Variable 2*
Mean	3.60513245	3.408653846
Variance	0.277519316	0.27274227
Observations	151	52
Hypothesized Mean Difference	0	
df	89	
t Stat	2.334581816	
P(T<=t) one-tail	0.010907908	
t Critical one-tail	1.662155326	
P(T<=t) two-tail	0.021815815	
t Critical two-tail	1.9869787	

Overview of Growth Mindset Inferential Statistics

The following research question was asked, and the corresponding hypotheses were tested to determine whether growth mindset can predict success in a collegiate professional pilot program:

Research Question 2: Is there a difference in growth mindset between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?

Null Hypothesis 2: There is no difference in mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Alternate Hypothesis 2: There is a difference in mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Refer to Table 8 and Table 9 to see the descriptive statistics for Growth Mindset Group 1 and 2. Growth Mindset is measured with 2 separate subscales known as intelligence and character. Therefore, the results for each separate subscale were tested independently. The following assumptions must be met for a hypothesis test comparing two population means.

1. Simple random samples
2. Independent samples
3. Normal populations or large samples
4. Equal population standard deviations

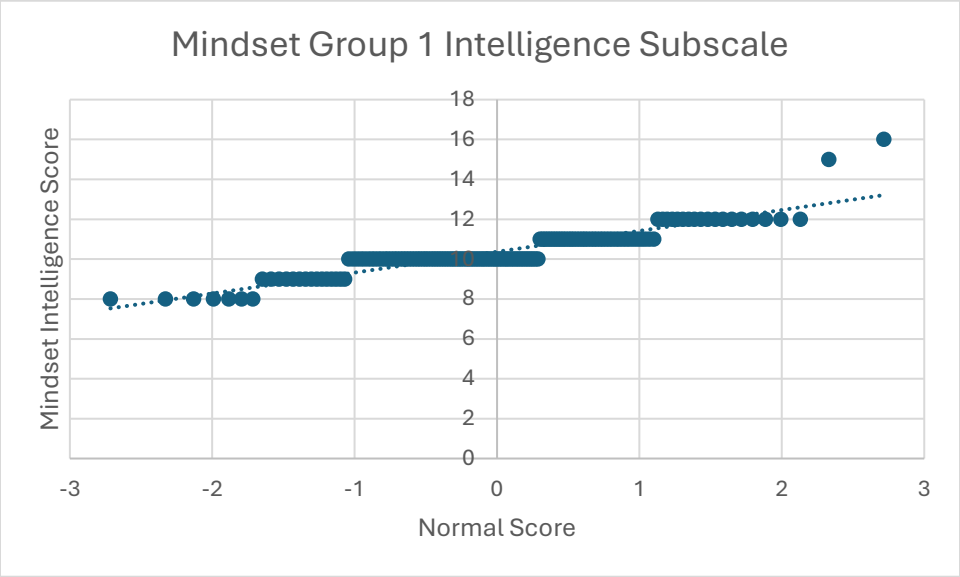
Checking the 4 conditions above required for using the T-Test to compare 2 population means:

1. The samples were simple random samples. Therefore, assumption 1 was satisfied.
2. The samples were independent. Therefore, assumption 2 was satisfied.
3. Normality was checked with probability plots (Figures 9, 10, 11 & 12). The samples were also very large (151 & 52). Therefore, assumption 3 was satisfied.

4. Levene's Test results of the sample variances for grit and both mindset subscales were greater than the .05 significance level. The sample variances were not significantly different.

Figure 9

Mindset Group 1 Intelligence Subscale Probability Plot



A two-sample t-test was conducted comparing the mean scores of Growth Mindset Group 1 Intelligence Subscale (mean = 11.70198675, SD = 2.328933095) and Growth Mindset Group 2 Intelligence Subscale (mean = 12.21153846, SD = 2.483960614). A separate two-sample t-test was conducted on the mean scores of the Growth Mindset Group 1 Character Subscale (mean = 11.66887417, SD = 1.798969536) and Growth Mindset Group 2 Character Subscale (mean = 11.76923077, SD = 1.86416553). See Table 11 and Table 12 for the results. The p-value in the

Figure 10

Mindset Group 1 Character Subscale Probability Plot

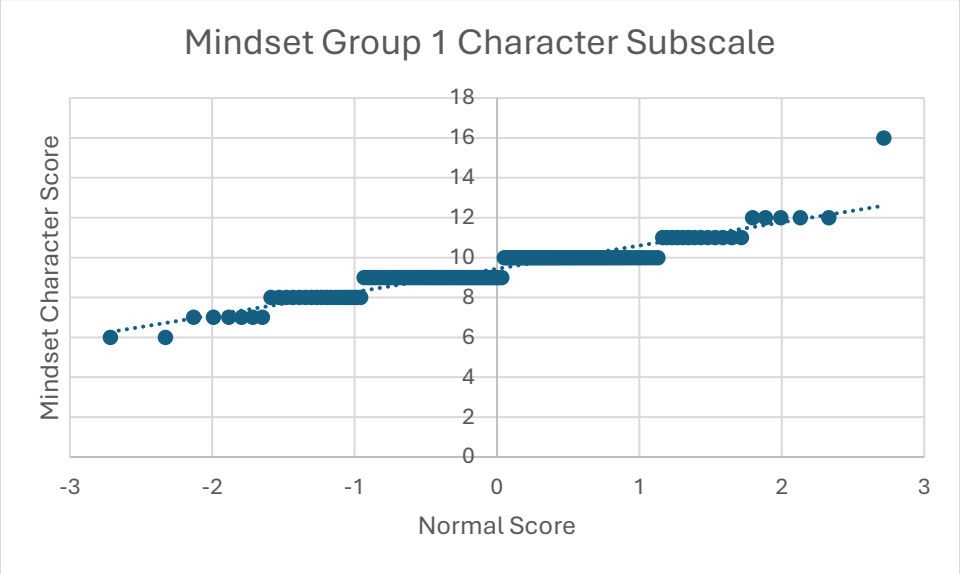


Figure 11

Mindset Group 2 Intelligence Subscale Probability Plot

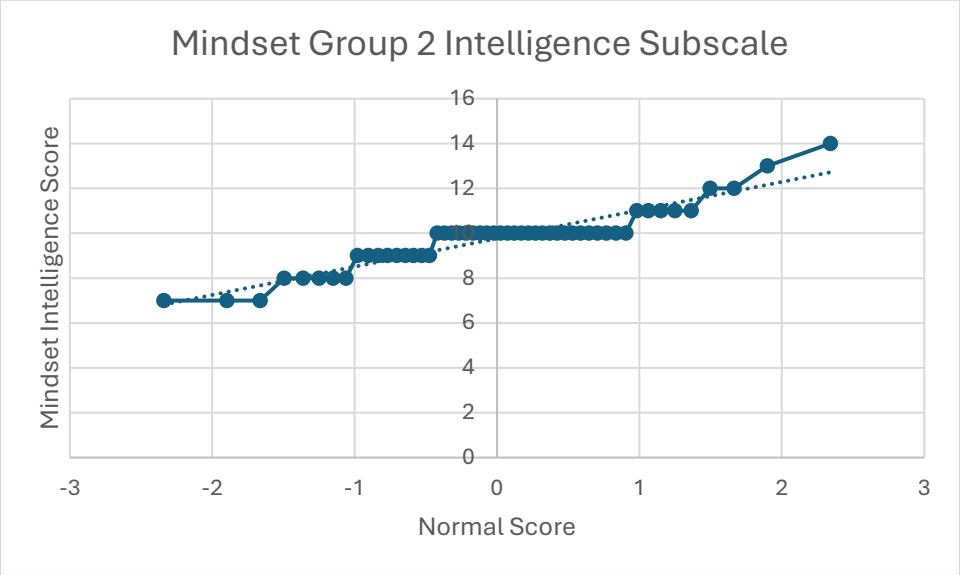
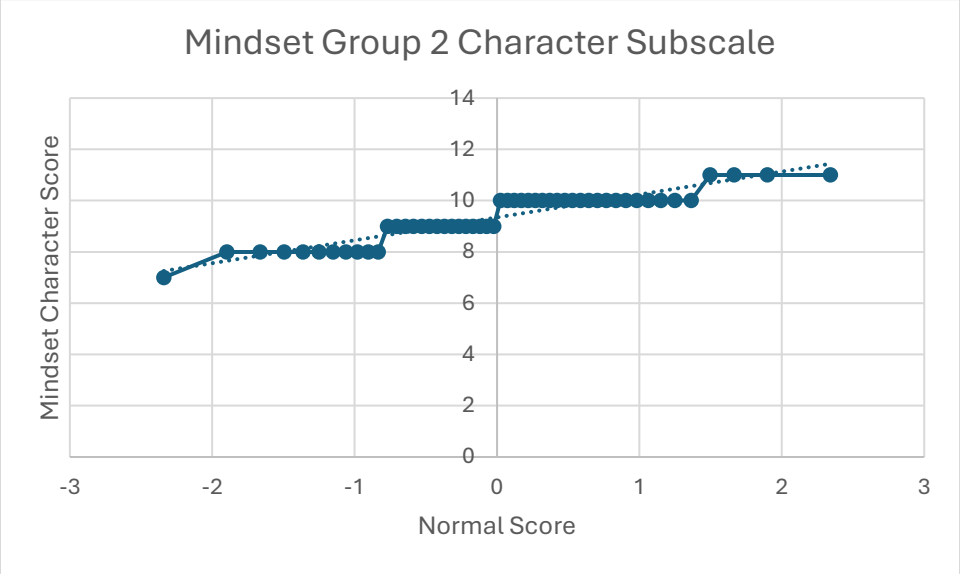


Figure 12

Mindset Group 2 Character Subscale Probability Plot



two-tail t-test for both subscales was greater than 0.05. Therefore, there was no statistically significant difference between the mean scores of Growth Mindset Group 1 and Growth Mindset Group 2. Therefore, we did not reject the null hypothesis that states that there is no difference in growth mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration.

Table 11

t-Test: Two-Sample Assuming Unequal Variances

Growth Mindset Intelligence Subscale

	Variable 1	*Variable 2*
Mean	11.70198675	12.21153846
Variance	5.42392936	6.170060332
Observations	151	52
Hypothesized Mean Difference	0	
df	84	
t Stat	-1.296040392	
P(T<=t) one-tail	0.099255654	
t Critical one-tail	1.663196679	
P(T<=t) two-tail	0.198511307	
t Critical two-tail	1.988609667	

Table 12

t-Test: Two-Sample Assuming Unequal Variances

Growth Mindset Character Subscale

	Variable 1	*Variable 2*
Mean	11.66887417	11.76923077
Variance	3.236291391	3.475113122
Observations	151	52
Hypothesized Mean Difference	0	
df	86	
t Stat	-0.337800505	
P(T<=t) one-tail	0.368168352	
t Critical one-tail	1.662765449	
P(T<=t) two-tail	0.736336703	
t Critical two-tail	1.987934206	

Reliability of Test Instruments

To test the reliability of the Grit-S and Growth Mindset Subscale instruments, Chronbach's Alpha was calculated for each instrument. A low Chronbach's Alpha score below 0.7 is considered

to indicate poor internal consistency within test items or questions. In other words, the questions may not be measuring the same concept or some of the questions may not measure the same concept as other questions in the test instrument. The Grit-S instrument's Chronbach's Alpha was 0.699433 or just below the 0.7 Alpha value considered acceptable. The Growth Mindset Intelligence Subscale Alpha was 0.823267 which was above the 0.7 Alpha value considered acceptable, and the Growth Mindset Character Subscale Alpha was 0.626677 which was below the minimum. However, the combined Chronbach's Alpha for both Growth Mindset Subscales together was 0.711875 which was above the 0.7 Alpha value considered acceptable.

Description of Phase 2 Participant Groups

In the second qualitative phase of this study, a purposeful sample of 8 participants were randomly selected. These participants who had previously completed the Grit-S and Mindset instruments and met the criteria for the purposeful sample were selected to participate in semi-structured interviews which were designed to explain and clarify the Phase I quantitative results of this explanatory sequential mixed methods research study. Two groups of 4 participants were randomly selected from a group of 117 participants who volunteered to be interviewed. The first group of 4 students had both enrolled in and intended to graduate in the Professional Pilot concentration. This group (Group 1) consisted of 3 seniors and 1 junior. The second group of 4 students had enrolled in the Professional Pilot concentration but intended to graduate in another Aerospace concentration. The participants in this group (Group 2) were all seniors.

Data Collection

Qualitative data was collected through 8 virtual interviews on the Zoom platform that lasted between 20 and 30 minutes each. These interviews were recorded with the permission of each

participant and destroyed after being uploaded to Adobe Premier Pro for transcription. The initial quantitative analysis was conducted to answer the first two research questions. This was followed by an explanatory qualitative analysis to answer the third research question: What is the difference between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? The structure of the interview protocol was designed to identify differences between Group 1 and Group 2 in their experience with long-term projects and goals as well as their attitudes about intelligence and learning. The interview protocol is included in Appendix A.

Data Analysis

Immediately after recording the interviews on Zoom, the recordings were uploaded to Adobe Premier Pro for automatic transcription. When the transcriptions were completed and cleaned, the Zoom recordings were destroyed to ensure the privacy of each participant. To protect the identity of each participant, pseudonyms were assigned (see Table 13). The transcripts were edited for clarity and sent to each participant by email for review to ensure accuracy. Every participant responded and confirmed the accuracy of their transcripts. The transcripts were then uploaded to qualitative research coding software (dedoose) to help with the coding process and efficiently organize, manage, and analyze the transcript data.

The amount of demographic information collected was limited to protect the identity and privacy of the participants. Some of the participants in the second qualitative phase of this study were students from one of the researcher's upper-level Aerospace classes. Others were recruited from upper-level Aerospace classes of fellow Aerospace faculty members from the Aerospace

Table 13

Participant Pseudonyms and Demographics

Pseudonym	Group	Class	GPA	Concentration
Andrew Boyer	Group 1	Senior	3.6	Professional Pilot
Mike Walton	Group 1	Senior	4.0	Professional Pilot
Lester Doyle	Group 1	Senior	3.8	Professional Pilot
Mary Grady	Group 1	Junior	3.9	Professional Pilot
Matt Vanna	Group 2	Senior	3.4	Aviation Mgmt.
Peter Carrier	Group 2	Senior	3.3	Flight Dispatch
Larry ODonal	Group 2	Senior	3.9	Aerospace Tech.
Jasper Banks	Group 2	Senior	3.6	UAS

Department of Middle Tennessee State University. The following is a brief description of each participant.

Group 1 participants were Andrew Boyer, Lester Doyle, Mike Walton, and Mary Grady. Andrew Boyer was a male Aerospace student from Virginia who enrolled and stayed in the Professional Pilot concentration. He was in his last semester before graduation and was recently hired by the MTSU flight school to be a flight instructor. He was a senior, and his GPA at the writing of this dissertation was 3.6. Lester Doyle was a male Aerospace student from Tennessee who enrolled and stayed in the Professional Pilot concentration. He was a senior, and his GPA at the writing of this dissertation was 3.8. Mike Walton was a male Aerospace student from South Carolina who enrolled and stayed in the Professional Pilot concentration. He was a senior, and his GPA at the writing of this dissertation was 4.0. Mary Grady was a female Aerospace student from

Tennessee who enrolled and stayed in the Professional Pilot concentration. She was a Junior and, her GPA at the writing of this dissertation was 3.9.

Group 2 participants were Matt Vanna, Jasper Banks, Larry ODonal, and Peter Carrier. Matt Vanna was a male Aerospace student from Tennessee who enrolled in the Professional Pilot concentration and switched to Aviation Management before graduation. He was a senior, and his GPA at the writing of this dissertation was 3.4. Jasper Banks was a male Aerospace student from Tennessee who enrolled in the Professional Pilot concentration and switched to Unmanned Aircraft Systems before graduation. He was a senior, and his GPA at the writing of this dissertation was 3.6. Larry ODonal was a male Aerospace student from Georgia who enrolled in the Professional Pilot concentration and switched to Aerospace Technology before graduation. He was a senior, and his GPA at the writing of this dissertation was 3.9. Peter Carrier was a male Aerospace student from Michigan who enrolled in the Professional Pilot concentration and switched to Flight Dispatch before graduation. He was a senior, and his GPA at the writing of this dissertation was 3.3.

The first cycle coding method used was concept coding. According to Saldana (2016), concepts can represent a process. A conceptual process is an action that can be observed. For example, someone who spends a day shopping and purchasing clothing is engaged in activities that are observable. These observable actions can be summarized into the broader concept called consumption (Saldana, 2016). For example, the following is an excerpt from the transcript of the interview with Jasper Banks:

- Question: Do you believe people can change their abilities and intelligence over time? Why or why not?

- Answer: If you put in the effort and you at least attempt and try to learn, intelligence is going to come as part of that mixture.

The following concept code was assigned during the first cycle coding:

- Effort and time more important

The second cycle of coding involved pattern coding. See Appendix B for a complete list of pattern codes and associated concept codes. According to Saldana (2016), pattern coding is a method of summarizing codes into a smaller number of categories. See Table 14 for concept codes associated with the pattern code *intelligence can be improved*:

Table 14

Concept Codes with Pattern Code Intelligence Can Be Improved

Concept Codes	Description
Always more to learn	Belief in continuous learning
Effort & time more important	Effort & time will lead to improved intelligence
Experience improves Intelligence	Experience and not just time and effort led to intelligence
Intelligence is not innate	You are not born intelligent
Push beyond comfort zone	Intelligence can be improved by pushing yourself outside of comfort zone
Talent not enough	Talent is not enough to succeed. It takes work

A total of 9 pattern codes were identified during the second cycle coding. See Table 15 for a list of the pattern codes along with a description of each one.

Table 15

Pattern Codes and Their Descriptions

Pattern Codes	Dexcription
Overcoming barriers	Barriers or challenges do not defeat
Success strategies	Developed strategies for success
Defeated by barriers	Barriers and challenges tend to defeat
Discouraged by Failures	Failure leads to discouragement
Intelligence can be improved	A belief that intelligence is not fixed
Learned from failure	Failure is an opportunity to learn
Positive view of criticism	Try to learn from criticism
Intelligence is fixed	Intelligence cannot be improved
Negative view of criticism	Has difficulty accepting criticism

The purpose of this explanatory sequential mixed methods study was to determine if students who enroll and eventually graduate in a collegiate professional pilot program differ significantly in grit and growth mindset from students who enroll in a collegiate professional pilot program but graduate in another concentration. Therefore, the pattern codes and corresponding concept codes were organized under the themes of high grit, low grit, growth mindset, and fixed mindset. Any concept and pattern codes that demonstrated a commitment and passion for long-term goals was categorized under the theme of high grit. Concept and pattern codes that did not demonstrate passion and perseverance for long-term goals were categorized under the theme of low grit. In addition to these themes, two sub-themes emerged under the theme of high grit. These sub-themes related to how the participants were motivated. Some of the participants were more internally motivated, while others were more motivated by outside influences or externally

motivated. The theme of growth mindset included data that demonstrated a belief that intelligence can be improved. Data that demonstrated a belief that intelligence is fixed was categorized under the theme of fixed mindset. See Table 16 for a summary of these themes with the associated pattern codes and sub-themes. The following section presents a within group analysis for Group 1 and Group 2 concerning the 4 themes and 2 sub-themes. Then a comparative analysis of Group 1 and Group 2 is presented.

Table 16

Themes With Associated Pattern Codes

High Grit	Low Grit	Growth Mindset	Fixed Mindset
Overcoming barriers	Defeated by barriers	Intelligence-can-be improved	Intelligence is fixed
Success strategies	Discouraged-by failures	Learned from failure	Negative-view-of criticism
Sub-theme-internally motivated		Positive-view-of criticism	
Sub-theme-externally motivated			

Within Group Analysis: Group 1

Participants in Group 1 were Aerospace students who initially enrolled in and intend to graduate from the Professional Pilot concentration. These students typically carry a course load between 5 and 6 classes while also completing flight labs each semester. Professional Pilot students who are awarded flight labs are required to complete a lab activity at least 4 times a week. A lab activity is either a flight lesson or a ground lesson with the student's assigned flight instructor and can take between 1 and 3 hours to complete.

When asked to describe a long-term goal that he has pursued, Lester stated that his long-term goal was to complete the Professional Pilot program, and Mike said that his "long-term goal is to achieve getting to the airlines." Mary chose to describe a long-term goal that she had in high school: "I wanted to be a valedictorian, or at least at the top of my class." Andrew answered without hesitation: "So, being an airline pilot is the goal, and I am currently in what I like to call phase two of that, and that is I've completed all my ratings, and now I am time building." Andrew also admitted that it has been "a long process" with the challenges of school and flight training but then started to talk about what motivates him.

Theme One: High Grit

The pattern codes that were categorized under the theme of high grit included overcoming barriers and success strategies. See Table 17 for a list of concept codes that were categorized under the pattern codes overcoming barriers and success strategies. When asked if he faced any challenges that he had to overcome, Andrew stated that he had failed his commercial pilot check ride. This was his first and only failure in the Professional Pilot program. When asked how he coped with this challenge, he replied: "I coped with it by laughing at it. Kind of making jokes. Oh, one of these days, I'm going to come back and look at this and laugh at it, but it also taught me a lot." Also, when asked if there was any other long-term goal in the past where he encountered an obstacle or a setback, Andrew replied:

> In high school, I wanted to finish my private pilot's license before I graduated, and it came with a lot of difficulties. Five instructors later, one of which passed away, one of which, you know, no showed me and then one of which made me repeat the same lesson for, I guess monetary gain. I quit. I quit for 6 months. I was frustrated, I was like, well, this is impossible. I'm never going to get this done.

When he realized that he would not succeed by ignoring the problem, he sought help from a younger instructor who understood his frustration because he had a similar experience. As a result, Andrew was able to earn his Private Pilot License before his high school graduation.

Table 17

Overcoming Barriers and Success Strategies & Concept Codes

Overcoming Barriers	Success Strategies
Ask for help	Be proactive
Don't quit	Breaking down tasks
Effort & Persistence	Change concentration
Giving up is accepting failure	Have fun
Humor	Setting goal
Overcame financial challenge	Setting high goal
Patience & Trust	Taking a break
Research	Tenacity
Sticking to plan	Visualization
Training the mind	

When asked to describe any challenges he faced completing the Professional Pilot program at MTSU, Lester said that cost was his biggest challenge. He overcame this financial challenge by joining the military. When asked how he handles situations where success doesn't come quickly or easily, Lester answered:

> I mean, with my private and instrument labs, I ended up waiting up to 2 months for check rides. And so, keeping me from being able to fly the next semester. And it was kind of demoralizing. Getting labs done at the rate of 1 per year. But still just looking at the light

> at the end of the tunnel. I'll get that done eventually. I mean, and recently with the commercial, I was able to get it done on time. Okay, but yeah, just sticking to it.

When asked how he stays motivated when working toward a long-term goal, Mike stated that he is motivated by a man named David Goggins who was a Navy Seal and Army Ranger. To stay motivated, he stated:

> I kind of used his guidance on how to train the mind to overcome difficulties. No matter what, if your mind tries to trick you, you think you can't go any further. You can always go further. Nothing is impossible as long as I push and continue to try as hard as I can.

When asked how she responds when encountering obstacles and setbacks, Mary responded:

> Obstacles? Yeah, respond. Well, think about it. I just like to think about them, so. Big picture overview. What is the obstacle? Why is it an obstacle? So, just think about it a lot, and then I just push through it. I don't give up. I try to push through and learn from them.

Also under the theme of high grit was the pattern code success strategies. Many of the participants in Group 1 employed different strategies to be successful. For example, Andrew described how he approached big tasks by breaking them down into smaller tasks. He also employed visualization to stay motivated. When asked what keeps him going when he feels like giving up, he answered:

> It's honestly like subtle reminders. For example, when I failed my commercial check ride, that for two weeks, I was completely stone cold. No, no flying. And then one evening, I drove up to Nashville Airport, sat at the observatory deck, nice sunset evening, and turned on some music and just watched airplanes. And then I was like, yep, this is like, I want to

do this. So, it's kind of not necessarily fantasizing about the goal, but kind of exposing myself to what it would be like.

Lester tries to learn from related experiences as a success strategy. He worked air traffic control in the military. He said, "For me, I guess I was trying to relate it to my pilot curriculum. Trying to find correlations with that."

Theme Two: Low Grit

The pattern codes that were categorized under the theme of low grit included defeated by barriers and discouraged by failures. See Table 18 for a list of concept codes that were categorized under these pattern codes. Group 1 participants experienced barriers and setbacks when working toward their goals, and they sometimes reacted negatively. For example, Andrew's initial reaction to the difficulties he encountered while earning his Private Pilot's License before he graduated from high school was to quit flying for 6 months. He also had difficulty dealing with failure when he was rejected for employment as a flight instructor by multiple flight schools. Lester felt defeated early in his academic career. He said, "I didn't feel like I would understand how to fly a plane going to ground school for the first time before I ever went to MTSU, realizing how much information goes into it." When asked about challenges she encountered during her training, Mary said, "Challenges? Yes, like some of the classes were hard or some of the tests I might have failed. And I thought, oh, my grade is going to reflect poorly and then I won't be able to achieve my goal." She also stated that "failures and mistakes slow me down a little bit."

Table 18

Defeated by Barriers and Discouraged by Failures

Defeated by Barriers	Discouraged by Failures
Barrier to achieving goal	Difficult classes
Burnout	Difficulty dealing with failure
Doubt ability to learn	Failures slow me down
No coming easily	

Theme Three: Growth Mindset

There were 3 pattern codes categorized under the theme growth mindset: Intelligence can be improved, learned from failure, and positive view of criticism were all identified as patterns that fall under theme three, growth mindset. See Table 19 for a list of concept codes that were categorized under these pattern codes. Andrew expressed a positive view of criticism when asked how he views feedback. He said, “I like to learn things through feedback. Also, when asked how he views mistakes, he said, “Sometimes, the necessary things you’re not learning can only be obtained through failure.”

When asked if he believes that people can change their abilities and intelligence over time, Andrew expressed the belief that there is a difference between effort and ability. He said, “I believe there’s a huge difference in, you know, effort versus ability.” Although Andrew believes that some people have natural talent which gives them an advantage, and some people are disadvantaged due to learning disabilities, he said, “But if you don’t have any of those (learning disabilities), I think that you can definitely make the change.” When asked how he responds to feedback or criticism,

Table 19

Intelligence Can Be Improved, Learned from Failure, & Positive View of Criticism

Intelligence Can Be Improved	Learned From Failure	Positive View of Criticism
Always more to learn	Learned from mistakes	Learned from feedback
Effort & time more important	Must fail to learn	Open to criticism
Experience improves intelligence		Open to genuine criticism
Intelligence is not innate		Learned from related experience
Push beyond comfort zone		Understanding vs. memorizing
Talent not enough		

Lester said, "I guess it depends on how the feedback or criticism is delivered. But if it seems like it's genuine…I'm usually open to receiving it." When asked how he views mistakes or failure in his learning progress, Lester responded, "I think it's just part of the process. You know, you must fail sometimes to learn from it." Mike expressed a belief that intelligence can be improved when he said, "Until I really came to college and really proved to myself that I could grow and become a better version, just growing my intelligence." Mary also expressed a belief that intelligence can be improved through effort when she said, "I do think intelligence can be changed. If you really work hard at it, you can become smarter."

Theme Four: Fixed Mindset

See Table 20 for the concept codes and pattern codes that represent theme four. Although most of the Group 1 participants expressed support for the belief that intelligence can be improved,

they also expressed some reservations. Although Andrew said that he likes to learn from feedback, he also said "Sometimes I do find it hard to swallow my pride." Andrew also

Table 20

Intelligence is Fixed and Negative View of Criticism

Intelligence is fixed	Negative view of criticism
Differences in talent	Difficulty with negative criticism
Some people think better	Ego problem

made several statements that contradicted previous statements that indicated a belief that intelligence can be improved. When describing how he and his brother are different, Andrew said, "I've always said, it's just because he's smarter than me. He's naturally good at it. I do think some people are able to process information better. I think that some people definitely have an advantage." Lester expressed a negative view of criticism when he said, "I'm usually open to receiving it (criticism). But, you know, if it's more of a negative connotation and the deliverance of the feedback, I'm usually not as open." Although Mike previously stated that he can improve his intelligence through constructive feedback, he also said,

> I'm now pretty much a senior, but when I first came in, I didn't take it, feedback, very well because I had a pretty big ego. I thought I was good. I thought I was great. I thought I was amazing at everything.

Sub-themes: Internally and Externally Motivated

Two sub-themes emerged under the theme of high grit. In answer to questions concerning grit, Group 1 participants described how they stayed motivated to complete long-term projects such as completing a flight lab. What emerged were statements that described how some participants were

internally motivated or self-motivated while others were motivated more by outside influences such as friends and family. See Table 21 for the concept and pattern codes that represent these two sub-themes:

When asked how he stayed motivated in pursuit of his long-term goals, Andrew revealed his passion for aviation when he said, “it’s something that I enjoy.” In response to a question concerning how he maintains interest and focus, Andrew described how he approached improving his performance on his high school golf team. “So, I started playing in my freshman year high school. I never played before. And then I fell in love with the process of getting better.”

Table 21

Pattern Codes Internal Motivator and External Motivator

Internal Motivator	External Motivator
Focusing on self	Fear of being wrong
Motivated by faith	Fear of letting people down
Motivated by progress	Motivated by negative consequences
Optimism in solving problems	Peer advice
Passion for aviation	Peer failures
Past regrets	Peer success
Proud	Potential earnings
	Pushed by family and friends

Andrew also indicated that he is motivated by outside influences such as the potentially high income of an airline pilot. In addition, he said, “But it’s also seeing my peers that have gone on to

accomplish the same goal that I have seeing them. And, then it's kind of like, oh, it's possible I can do that." When dealing with the time he failed his commercial check ride, Andrew said, "And you know, my cousin, his first two check ride failures, one of which being his CFI. So, kind of found common ground through that." Seeing that his peers also failed check rides was motivating when Andrew said, "And when I find comfort in knowing that I'm not the only one dealing with this, it makes it a lot easier for me to get through an obstacle." When asked how he usually responds when encountering obstacles and setbacks, Lester said, "I'd say I'm usually optimistic about things. I know there always seems to be some sort of solution." When asked what keeps him going when he feels like giving up, Mike said,

> As a kid, I always gave up on a lot of things I said I was going to do. And as I grew older, I realized I didn't like being that person anymore. So, whenever I set goals, I always make sure that I stick to them no matter what. I remind myself of this any time I sit there and think, I don't want to do this anymore. I remind myself that I should and that I can't quit.

When Mary was asked how she stays motivated, she answered that she tries to keep the focus on herself and not worry about what other people are doing. However, she also said, "Honestly, I just want to make my parents proud."

Within Group Analysis: Group 2

The participants in Group 2 were Aerospace students who started their college careers in the Professional pilot concentration but eventually switched to another Aerospace concentration before graduation. Aerospace students in Group 2 take from 4 to 6 classes a semester, but they are not required to take any flight labs. See Table 4 for details about each participant in Group 2 and the Aerospace concentration from which each participant plans to graduate.

When asked to describe a long-term goal, Jasper said, “My long-term goal initially was to be a crew chief in the army.” Peter said his long-term goal is “still ongoing, which is to become a pilot or honestly, just to get into a major airline.” Harry chose to describe a research project that he is doing in one of his classes, and Matt said, “It’s just been the goal of becoming a pilot and passing the classes necessary to do so.”

Theme one: High Grit

The theme of high grit included the pattern codes of overcoming barriers and success strategies. Refer to Table 17 for a list of concept codes that were categorized under these pattern codes. When asked how he stays motivated in the face of obstacles and barriers to achieve his goals, Jasper said that he falls back on his military training. He said, “I was in the Army in a special operations aviation regiment. And they taught us our motto was night stalkers don’t quit.” When Peter was asked how he handles situations where success doesn’t come easily, he said, “I just told myself it’s got to be done. I just kind of tell myself that, you know, don’t give up that easily.” Later in the interview, Peter said, “I’ll never back down. That’s all you really need. And like, as well as intelligence, you know, just keep trying. Just don’t give up. That’s really what it is about. Even If you must learn a different way, it’ll eventually come around.” When describing his approach to a challenge encountered during his class research project, Harry said that he needed to be creative and adapt to the situation to successfully complete the project. When asked what keeps him going when he feels like giving up on something important, Matt simply said, “It just needs to be done.”

Participants in Group 2 employed many different success strategies when working on long-term projects and goals. Jasper switched from Professional Pilot to the UAS concentration because of a medical issue that prevented him from obtaining a FAA medical certificate. He said, “I circumnavigated and found myself applying for unmanned aerial systems which does not require

a flight medical. And while my circumstances made it not possible to get my flight ratings, I'm still very much able to obtain my degree." Peter switched to the Flight Dispatch concentration. He explained,

> The biggest thing is, is that I think a lot of it was on me and just my unpreparedness. And although I didn't continue to pursue Pro Pilot through here, I did get it outside. And I've even got my instrument and commercial outside. Sometimes, those goals can change, and you might have to be able to reach them in a different way.

When asked how he approaches long-term projects, Harry explained that he likes to break large projects down into smaller tasks and making note of what is working. He said,

> But it really comes down to putting it into smaller steps and tackling the smaller challenges. As I've been taught in classes and even in life, it is just look at a problem and write down all the good things that are happening. What do I know about the problem?"

Matt has a simple success strategy. He explained, "Whatever comes along. I'll take advantage of it and make the best of it." Matt is also proactive. When asked how he stays motivated, Matt said, "I have been like. Getting out there more and seeing what I can do to be more self-sufficient. So, instead of waiting until the last moment of an assignment, do it more on a schedule."

Theme Two: Low Grit

Refer to Table 18 for a list of concept codes that were categorized under the pattern codes defeated by barriers and discouraged by failures. These pattern codes represent the second theme, low grit. Jasper felt defeated when he lost his FAA medical certificate. He explained,

> Well, the first thing that I did was I thought I had to seek counseling. And that kind of helped me realize that I was stressing myself out, and I was placing my goal into too high regard, and I was pretty much becoming motivated burnout.

When explaining the challenges he faced in pursuit of his goal, Peter said, "You know, first year pilot, you know, something doesn't go my way. I'm kind of one of the people that, you know, I get knocked down. It takes a lot for me to get back up." When asked how he views mistakes, Matt said,

> I do tend to beat myself up about mistakes that I may call myself an idiot frequently, but like it's nothing that would really get you down. Like when I made the mistake on the check ride back in there. I blamed everything else for what happened. I blame the instructor. Everything under the sun except me because it was easy.

Theme Three: Growth Mindset

The Three pattern codes categorized under the theme growth mindset included intelligence can be improved, learned from failure, and positive view of criticism. See Table 19 for a list of concept codes that were categorized under these pattern codes. When asked if he believed that people could change their abilities and intelligence over time, Jasper said, "Yeah, I think anybody's willing to change or able to change. If you put in the effort and you at least attempt and try to learn, intelligence is going to come as part of that mixture." When asked which he felt was more important in developing a skill or knowledge; talent or time and effort, Jasper said,

> I think effort and time. Everybody learns at a different pace and everyone has raw talent. But, if somebody can put in their effort and time, they're going to see results. And not only that, but you can have talent in something, a natural born talent and not use a lot of effort

> and just get by. But there is going to be a time when you're going to face adversity, and that talent is not going to be enough to get you through it.

Peter said that he views criticism as a learning opportunity. When asked if he believed that people could change their abilities and intelligence over time, Peter said the following.

> Like you know, maybe you're good at math, whereas there are people who aren't good at math like me. I'm terrible at math, but you know, you keep trying, you stop, you still end up wherever you stop. And you, even if you don't do good, you still have a little bit of intelligence from that experience alone.

When asked how he views mistakes or failures in his learning process, Harry said,

> I know that mistakes are natural. Failure is a very strong word for me, as I define failure as not learning from your mistakes. I take failure very seriously. And the fact that whenever I do make a mistake, as everyone does, I make the best effort to learn from those. So, I do not fail.

In response to the question about how he reacts to feedback and criticism, Matt said, "Nobody likes to take criticism, but I've learned to accept it and run with it more after experiences, because it's just better to just bite the bullet and take and make that self-improvement necessary."

Theme Four: Fixed Mindset

Pattern codes with corresponding concept codes that represent the fourth theme of fixed mindset can be seen in Table 20. As previously reported, the students in Group 2 frequently expressed the belief that intelligence is not fixed. However, many also seemed to feel that some people with talent or natural abilities may have an advantage. Some also expressed that they have

issues with learning from feedback and criticism. For example, Jasper said, “criticism can be a hard pill to swallow and some criticisms are tough to deal with.” When Peter was asked if he believed that people could change their abilities and intelligence over time, he said, “This one’s kind of tricky. Yes, I don’t want to say no because there are some things that people are just naturally gifted at.” When asked how he responds to feedback or criticism, Harry said that you must make mistakes to learn, but he then qualified his comment by saying, “Some of the comments seem very negative. A comment that is very extremely negative is very demoralizing.” Although Matt expressed the belief that effort is more important than natural talent, he added, “Natural talent does make it a lot easier to keep going because there’s a lot less things to look at and worry about.”

Sub-themes: Internally and Externally Motivated

See Table 21 for the concept and pattern codes that represent these two sub-themes of Internally Motivated and Externally Motivated. Group 2 participants frequently expressed how they are externally motivated when asked about how they respond to obstacles or setbacks in pursuit of a long-term goal. Students who are internally motivated rely on something within themselves to keep motivated. Students who are externally motivated rely on something outside themselves such as family and friends to keep them motivated. For example, when Jasper was asked about what challenges he faced and how he stayed motivated to overcome those challenges, he said, “A backbone of mine is my family. My wife kept me motivated.” When asked what keeps him going when he feels like giving up, he responded, “My family. I really have it in the forefront of my mind, and I don’t want to let them down. So, I want to make my family proud. So, that’s always a driving factor.” These statements demonstrate motivation from outside sources, but later when asked how he maintains interest and focus, Jasper said, “I try to see the end goal. I start something out, make a little progress, and then go back to the instructions. And once you can see

a little progress, it's a snowball effect." Jasper is not only motivated by outside sources such as his wife and family, but he also looks to increase self-motivation by looking for signs of progress. When asked to describe some challenges he faced and how he stayed motivated, Peter said,

> I still had my friends push me towards getting it regardless of anything that would happen. I'm more of an extrovert. I have people that I surround myself that love me and cherish me, and then they'll help me get going as well. As I said, my friends, my family, my mom. I know she'd be let down if I gave up and stopped trying.

In addition to being motivated by outside influences, Peter is also internally motivated by his faith. He said, "And honestly, another thing too is that I know as a Christian, we're going to encounter a bunch of tough times and a bunch of tough challenges that God is going to give us." When asked what keeps him going when he feels like giving up, Harry answered, "Really, that other people believe in you." When asked to elaborate, he said, "Whether it be family, or sometimes even faculty that are saying you're right there, you're this close like, maybe even students." He added, "So, it's really having other people to help motivate me and other people believing that I can do so." In addition to being motivated by other people, Harry also described how he is self-motivated when he said, "It's really waking up each morning and seeing what's ahead and seeing what's next. Trying to see the positive aspects and all of it. Because the more positive that you see, the more you'll want to continue doing it." Matt demonstrated that he is primarily motivated by outside forces when he said, "If I don't do it, then there are consequences." This was in response to the question about what keeps him going when he feels like giving up.

Comparative Analysis: Group 1 and Group 2

The same themes and subthemes that were explored in the within group analyses were also explored in the comparative analysis of Group 1 and Group 2. Participants from Group 1 and Group 2 responded to the same open-ended questions during the semi-structured interviews. The answers to many of these open-ended questions by participants in Group 1 were very similar to the answers by participants in Group 2. However, there were some differences when looking at the pattern and concept codes for each group.

This explanatory sequential mixed-methods study began with quantitative data collection and analysis in the first phase. The statistical analysis of the answers to the Grit-S scale and the growth mindset questionnaire revealed that the grit scores for Group 1 participants were significantly higher than the grit scores for Group 2 participants, but growth mindset scores for Group 1 and Group 2 were not significantly different.

In the second phase, qualitative data was collected and analyzed to explain the quantitative results in more detail. Qualitative data was collected through semi-structured interviews with a random sample of participants from the first phase of this research study. The qualitative phase of this research was designed to answer the following research question: What is the difference between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? The first five questions of the semi-structured interview were focused on grit, and the next four questions were focused on growth mindset. The last question was designed to capture any remaining thoughts. See Appendix A for the complete semi-structured interview protocol. In the following comparative analysis, answers to these questions by participants in Group 1 and Group 2 were compared to answer this research question. The

following comparative analysis provides a general synopsis of the overall response to each interview question using illustrative quotes. Some of these quotes are repeated from the within group analyses in the previous section.

Comparative Analysis Theme One: High Grit

The following questions were asked in the semi-structured interview with participants from Group 1 and Group 2:

Grit question 1: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated?

The two prominent pattern codes under the theme of high grit were overcoming barriers and challenges for Andrew and Mike from Group 1. For Jasper and Peter from Group 2, the most prominent pattern code under the theme of high grit was success strategies.

Andrew from Group 1 answered:

> Yep. So, being an airline pilot is the goal, and I am currently in what I like to call phase two of that, and that is I've completed all my ratings, and now I am time building. So, it's kind of like the subtle reminders when I fly commercially that keeps me motivated. I'm like, hey, I'm going to get there soon. But it's also seeing my peers that have gone on to accomplish the same goal that I have seeing them. And, then it's kind of like, oh, it's possible. I can do that. Oh, significant challenges. One of the most probable challenges was my commercial rating. I had a, I'd never dealt with failure. That was probably the biggest challenge. I coped with it by laughing at it. Kind of making jokes.

Mike from Group 1 answered:

So, a long-term goal is to achieve getting to the airlines. It's still currently going, but that has been my goal since I was 11 years old. Some of the major challenges I've faced were just the complications of studying, overcoming the challenges of certain courses and check rides, etc. the flight training, paying for it all. The way I motivated myself through it consisted of me, a kind of side story. But typically, the way I motivate, motivate myself is through my brother and my father. They have been huge motivational people to me. You always can go further. I continue to push it. Can you continue to train? And that's how you overcome the obstacles and the difficulties of these goals in your life. And pretty much it's just trained me how to. Nothing's impossible as long as I push and continue to try as hard as I can.

Jasper from Group 2 answered:

One of my highest goals was to become a pilot. And I was unable to obtain that goal because of a medical emergency. But I circumnavigated and found myself applying for the unmanned aerial systems major which does not require a flight medical. A backbone of mine was my family. My wife kept me motivated. Another thing was I relied on my army training. I was in the Army in a special operations aviation regiment. And they taught us our motto was night stalkers don't quit.

Peter from Group 2 answered:

Well, I think my long-term goal is still ongoing, which is to become a pilot or honestly, just get into a major airline whatsoever. For me personally, doing the pilot route has not been the most successful. It's been a little bit rocky. Which is unfortunate. But the only

reason why I did get back up was because I had a lot of friends who cared about me and helped push me towards my goal.

An example of how Group 1 participants were focused on overcoming barriers and challenges included Mike's comment saying that nothing is impossible as long as he pushes and continues to try as hard as he can. Jasper's comment about how he adjusted to the loss of his FAA medical certificate demonstrated how he used success strategies to achieve his goal.

Grit question 2: How do you usually respond when you encounter obstacles or setbacks while working toward a goal?

The following responses of the participants from both Group 1 and Group 2 to the second grit question reflected a similar pattern as their responses to the first grit question. The answers from Group 1 apart from Lester Doyle's answer were assigned the pattern code of overcoming barriers and challenges. Lester Doyle's response was assigned the pattern code internal motivator which will be discussed later in this comparative analysis. The responses from Group 2 participants were all assigned the pattern code success strategies.

Andrew Boyer of Group 1 answered:

That's not going to get it done by just ignoring the problem. So, I did some more research, found a younger instructor that our personalities kind of mashed up with more, got in touch, in contact with him. And then before we even flew, we kind of talked about all the conflicts that I've been through. And he said that, you know, that he had gone through similar things.

Lester Doyle of Group 1 answered:

I'd say I'm usually optimistic about things. I know there always seems to be some sort of solution. I don't think of myself as one to throw my hands in the air and say, there's nothing I can do about it. You know, I guess more try to find a solution to the problem.

Mike Walton of Group 1 answered:

Because I know I'm capable. These setbacks, they will push me down and try to trick me into thinking I can't do it. But at the end of the day, as long as I work hard and continue practicing and continue doing the procedures that everybody's taught me in throughout my educational career, I know I can overcome it.

Mary Grady of Group 1 answered:

Obstacles? Yeah respond. Well, I think about it. I just like to think about them. So, big picture overview. What is this obstacle? Why is it an obstacle? So, just think about it a lot, and then I just push through it. I don't give up. I try to push through and learn from them.

Jasper Banks of Group 2 answered:

I was able to understand that I needed to take a break. And when I took a break, I could reevaluate my long-term goals and realign myself with something more feasible and something more obtainable in the short term.

Peter Carrier of Group 2 answered:

Well, sometimes I just take a step back, you know, like with my, commercial failure.

Harry ODonal of Group 2 answered:

> At first it is hard. I first look at the problem and I'm like, oh, that that did not work. And as I've been taught in classes and even just in life, it is just to look at a problem and write down all the good things that are happening. What do I know about the problem?

Matt Vanna of Group 2 answered:

> I don't. It doesn't really bother me. I think the biggest problem is just overestimating the obstacle.

Mike Walton of Group 1 demonstrated a focus on overcoming barriers and challenges with his comment about working hard and continuing to practice. Harry ODonal of Group 2 uses a success strategy when faced with an obstacle. He said he looks at the problem and writes down all the good things that are happening. These comments illustrate the difference between Group 1 and Group 2 in how they approach long-term goals.

Grit question 3: What keeps you going when you feel like giving up on something important to you?

Responses to the third grit question were assigned pattern codes that were mixed between overcoming barriers and challenges, success strategies, external motivator, and internal motivator. The following answers from both groups were similarly coded except for the type of motivators that kept them from giving up on an important goal. Group 1 was more self-motivated while Group 2 was motivated mostly by sources outside of themselves such as family and friends or the threat of negative consequences. Although Lester Doyle of Group 1 mentioned that his motivation to keep going includes his wife, most Group 1 participants said that they were self-motivated while

most of the Group 2 participants said that family and social connections kept them going when they felt like giving up.

Andrew Boyer of Group 1 answered:

> Honestly, I have a lot of goals I want to achieve airline pilot being a main one and, you know, some other small ones. But it's honestly like subtle reminders. For example, when I failed my commercial check ride, I drove up to Nashville airport, sat at the observatory deck, nice sunset evening, and turned on some music and just watched airplanes. And then I was like, yep, this is like, I want to do this. So, it's kind of not necessarily fantasizing about the goal, but kind of exposing myself to what it would be like, just kind of enough to keep me chasing after what I want.

Lester Doyle of Group 1 answered:

> I mean, like I said, I guess the goal at the end of the tunnel. I am married. And so, my wife's been kind of pushing me along and kind of rooting for me the whole time. To the yeah, pride to myself and those around me because I put so much into this, you know, the whole reason I joined the military was to help fund it and kind of prepare me for the pilot route. I feel like everything that I've done, it's kind of helped try to have the intent of aiding me along that route, for sure.

Mike Walton of Group 1 answered:

> As a kid, I always gave up on a lot of things I said I was going to do. And as I grew older, I realized I didn't like being that person anymore. So, whenever I set goals, I always make sure that I stick to them no matter what.

Mary Grady of Group 1 answered:

What keeps me going is the fact that I don't want to fail at something. So, if I keep going, there is a better chance of me to succeed than if I just gave up right now. It would mean that I am accepting failure. So, I guess the thought that I don't want to fail is what keeps me going.

Jasper Banks of Group 2 answered:

My family. I really have it in the forefront of my mind, and I don't want to let them down. When you face adversity, rather than being crippled by it, you should be humble and then understand that it's not going to control you, but you can control it.

Peter Carrier of Group 2 answered:

As I said, my friends, my family, my mom. I know she'd be let down if I gave up and stopped trying.

Harry ODonal of Group 2 answered:

Really that other people believe in you. Whether it be family, or sometimes even faculty that are saying you're right there, you're this close like maybe it's even students,

Matt Vanna of Group 2 answered:

It just needs to be done. If I don't do it, then there are consequences.

Mary Grady from Group 1 demonstrated that she was self-motivated by saying that she doesn't want to fail, so she just keeps going. For Mary, giving up means accepting failure. On the other hand, Jasper Banks of Group 2 said that it is his family that keeps him going when he feels

like giving up on something that is important to him which is an example of how participants in Group 2 are more motivated primarily by friends, family, and others.

Grit question 4: Can you describe a time when you worked on a project or skill for an extended period? How did you maintain your interest and focus?

Because grit question 4 asked how participants were able to maintain interest and focus while working on a long-term project, most of the following responses from both groups were assigned the pattern code success strategies with a few exceptions. Harry ODonal of Group 2 said, “What do I need to review? What can I get better at? Really trying to see the positive aspects and all of it because the more positive that you see, the more you’ll want to continue doing it.” This response was assigned the concept code optimistic in solving problems and the pattern code internal motivator which will be discussed later when the subthemes internal motivator and external motivator are discussed.

Andrew Boyer of Group 1 answered:

I tried to set a goal that I would never fully achieve because then I would never be satisfied. As if that makes sense.

Lester Doyle of Group 1 answered:

Okay. So, through the military, air traffic control. And I guess, you know, I’ve deployed in, in my facility in system and radar. For me, I guess I was trying to relate it to my pilot curriculum. Trying to find correlations with that. I was not necessarily super interested in ATC.

Mike Walton of Group 1 answered:

Well, I'll use flying again because that's my focus. What I would do is not just focus on that main goal. And that became very apparent during my commercial training. How exhausting it could be. Can you tenuously try to train and push and try to get done within a semester for a check ride. What I learned was at the end of the day, I'll finish it.

Mary Grady of Group 1 answered:

Right. So. I, I mean, I was pretty interested in aerospace. So, I guess that's how I maintain my interest was just because I liked aerospace, and I wanted to keep improving my skills and the thought that I want to keep improving. I want to be better. I want to be a better pilot.

Jasper Banks of Group 2 answered:

That's a good question. I try to see the end goal, and what I do is, I start out and I go back. I start something out, make a little progress, and then go back to the instructions. And when you go back to the instructions, it keeps you on the task at hand. But it also shows you the progress that you've made. And once you can see a little bit of progress, it's a snowball effect.

Peter Carrier of Group 2 answered:

I got Microsoft Flight sim, even just doing goofy stuff, like trying to get a Cessna to do a barrel roll at like Mach ten. You know that kind of gets me. That kind of gets me a little bit re-inspired like, oh, you know what this you know, maybe it doesn't have to be so serious all the time. You know that just kind of keeps me going a little bit like, oh, take it seriously,

but don't be like, oh, this is life or death. But if you have a good time, it's going to help you.

Harry ODonal of Group 2 answered:

It's really waking up each morning and seeing what's ahead and seeing what's next. What do I need to review? What can I get better at? Really trying to see the positive aspects and all of it. Because the more positive that you see, the more you'll want to continue doing it.

Matt Vanna of Group 2 answered:

I keep on going is because I had the end goal, the end image, the end state in mind, and that made me keep going. And if I don't do it, then I'm probably going to not get there. You know?

Mary Grady from Group 1 said, "I want to keep improving. I want to be better. I want to be a better pilot." This answer was assigned the concept code of effort and persistence and the pattern code of overcoming barriers and challenges. Although most of the answers to this question fell under the pattern code success strategies, overcoming barriers and challenges was a common pattern code for Group 1 participants. Group 2 was more focused on success strategies. For example, Peter Carrier's comment about how he maintains interest and focus by making sure he takes time to have fun was assigned the concept code have fun and the pattern code success strategies.

Grit question 5: How do you handle situations where success doesn't come quickly or easily?

The following responses to this question from both groups were mostly focused on the pattern code overcoming barriers and challenges. Concept codes included don't quit, effort and

persistence, ask for help, research, and sticking to a plan. Exceptions included Peter Carrier of Group 2 who said, “Maybe it’s just taking it a different way.” This was assigned the concept code tenacity and the pattern code success strategies. Mike Walton of Group 1 said, “I just learned how to overcome that and realized I needed to take the time to sit and really understand the subject.” His answer was assigned the concept code understanding vs. memorizing and the pattern code success strategies. The most prominent pattern code for Group 1 was overcoming barriers and challenges and the most prominent pattern code for Group 2 was success strategies. Both were pattern codes under the high grit theme.

Andrew Boyer of Group 1 answered:

> For example, I got my CFI certificate in June. When I got the certificate, I thought, oh, I’m going to have a job within a week. Six months later, ten rejections or more later, I finally got it, and I was irritated. That was difficult. So then again, kind of doing what I did with failure, I sort of talked to others and tried to educate myself further and try and find a more realistic expectation. I knew I had to get it done to progress, to like it was a prerequisite for a couple class senior level classes. So, I honestly just looked at myself and was like, well, you can’t run from this this time, so don’t find comfort in that. Just do your best, show up.

Lester Doyle of Group 1 answered:

> Well, I mean, the first thing that came to my mind when you mentioned is not coming easily or quickly is just the pilot program in general. I mean, with my private and instrument labs, I ended up waiting, up to two months for check rides. And so, keeping me from being able to fly the next semester. Okay. But, yeah, just sticking to it and knowing that you know. Yeah, it’s a slow process and it’s going to take a while right now, but eventually,

you know, a five-year plan shows that, you know, it's all going to be over and done with. And I'm going to be, you know, glad I did it and enjoyed the process.

Mike Walton of Group 1 answered:

I just learned how to overcome that and realized I needed to take the time to sit and really understand the subject, rather than just try and memorize certain answers for certain questions. Because knowledge is crucial to learning, especially in a college class.

Mary Grady of Group 1 answered:

Well, I remember my communications class. There were a lot of speeches. So, it was different than other classes or just, like, writing assignments or just lectures or whatever it was. I had to give a lot of speeches. I had to put myself out there a lot. It was challenging for me. Just keep practicing. And then I started throughout the semester feeling less and less nervous about giving a speech in front of a class.

Jasper Banks of Group 2 answered:

I just spent as much time as possible networking and trying to navigate through calculus. I was able to meet the faculty. And they saw my face every day. And they saw that I was trying.

Peter Carrier of Group 2 answered:

I just told myself it's got to be done. And, you know, maybe it's just taking it a different way. Like, you know, instead of not going to get help, go get help every couple of weeks. I just kind of tell myself that, you know, don't give up that easily.

Harry ODonal of Group 2 answered:

I just know that a lot of things take time and sometimes you'll have days where everything just goes perfect, and other days it just won't. It's all about trusting that you can just take one step at a time. And as long as you're taking those steps forward and keeping a good attitude, then you will achieve your goal. So, the class I had last semester was called Mechanical Vibration. I tried to look up what other people have done before and that they were in similar situations in terms of the problem set. And I what my goal was to reverse engineer the problems until I understood it from, from the back. So, I was able to take a problem and then work my way backwards, which means I would be able to work my way forwards through it. I saw a lot of my fellow students also struggling with this.

Matt Vanna of Group 2 answered:

Chemistry. I just went to the tutoring hall. A lot of it's like for both calculus and for chemistry, I had to go to the tutoring hall for every single homework assignment because I was just completely lost. It really wasn't a challenge at all. Just come to the tutoring hall. If you have any questions, just go ahead and do it.

The predominance of the pattern codes success strategies and overcoming barriers and challenges in answer to grit question 5 lends support for high grit in both groups. However, there are interesting differences between Group 1 and Group 2. More Group 1 responses were assigned the concept code effort and persistence than the Group 2 responses which is consistent with the quantitative results in the first phase of this mixed methods study which indicated that Grit scores for Group 1 were significantly higher than Grit scores for Group 2. An example of these comments from Group 1 participants includes Andrew Boyer who said that he just knew he had to get it done

and just did his best to show up. Mary Grady of Group 1 said that she had to put herself out there a lot when she was faced with something that did not come easily to her.

Comparative Analysis Theme two: Low Grit

In the second qualitative phase of this mixed methods study, there were very few answers that were coded under the theme of low grit. The quantitative results of the first phase of this explanatory sequential mixed methods study found that Group 1 Grit-S scores were significantly higher than Grit-S scores for Group 2. On a scale of 1 to 5 where a score of 5 represents extremely gritty and a score of 1 represents not at all gritty, both groups scored relatively high in grit. The mean score for Grit-S Group 1 was 3.60513245 with a standard deviation of 0.526801021 and the mean score for Grit-S Group 2 was 3.408653846 with a standard deviation of 0.522247326. So, it is not surprising that the qualitative data in the second phase of this study did not indicate a low level of grit for either group.

Grit question 1: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated?

The pattern code and concept code assigned to Andrew Boyer's response to this question was discouraged by failure and difficulty dealing with failure respectively. Peter Carrier's response, "it was on me and just my unpreparedness' was assigned the pattern code defeated by barriers and challenges and the concept code barrier to achieving goal. The same pattern code was assigned to his response, "I failed it. So that was my first big blow and obviously my mental fortitude and stuff like that." The concept code assigned to this statement was not coming easily.

Andrew Boyer of Group 1 answered:

> Oh. Significant challenges. One of the most probable challenges was during my commercial rating. I had a, I'd never dealt with failure. And with really anything in my life. But I had a particularly tough examiner known at the flight school. And he failed me on my ground portion on my commercial check ride, and I thought my life was over.

Peter Carrier of Group 2 answered:

> The biggest thing is, is that I think a lot of it was on me and just my unpreparedness for what I was supposed to be expecting here, which obviously, I feel like a lot of people that did switch kind of are doing the same thing. We weren't ready for a 141 experience. Just how fast paced and how demanding it was. And like I said, it was rocky. I was in the private pilot stage when they still were doing the written test deadlines, and I got signed off to go do that when I didn't get my two 90's. So, I failed it. So that was my first big blow and obviously my mental fortitude and stuff like that.

There were instances where participants from both groups felt defeated by barriers and challenges. For example, Mary Grady of Group 1 said that she may have failed some difficult tests and struggled with difficult classes which was discouraging for her. Jasper Banks of Group 2 felt defeated when he failed to qualify for his FAA medical certificate.

Grit question 2: How do you usually respond when you encounter obstacles or setbacks while working toward a goal?

Again, the following excerpts were the only responses that were assigned the pattern code discouraged by failure and defeated by barriers and challenges.

Andrew Boyer of Group 1 answered:

So, let's say, one of the goals I had, in high school, I wanted to, finish my private pilot's license before I graduated, and it came with a lot of difficulties. Five instructors later, one of which passed away, one of which, you know, no showed me and then one of which made me repeat the same lesson for, I guess, monetary gain. I quit. I quit for six months. I was frustrated, I was like, well, this is impossible. I'm never going to get this done.

Mike Walton of Group 1 answered:

I failed my commercial EOC, for my flight training at MTSU. That's the only one I failed. So, it set me back a lot. That really destroyed my confidence.

Jasper Banks of Group 2 answered:

I was pretty much becoming motivated burnout. Just completely ignored my crew rest and everything like that and just wanted to accomplish my goal no matter what.

Andrew Boyer's response was assigned the concept code difficulty dealing with failure. Mike Walton's response was assigned the concept code failures slow me down. Jaspar Banks' response was assigned the concept code burn out. These codes demonstrate that participants from both Group 1 and Group 2 experience difficulties that they find discouraging. However, the relatively small number of responses that were assigned these codes supports the quantitative results of the first phase of this study that demonstrated a high level of grit for both groups.

Grit question 3: What keeps you going when you feel like giving up on something important to you?

There were no responses to grit question 3 that were assigned pattern codes defeated by barriers and challenges or discouraged by failure. Again, this result supports the quantitative results of the first phase of this study. Although the results of the statistical analysis confirmed that Group 1 Grit-S scores were significantly higher than the Grit-S scores of Group 2, both groups scored relatively high on the Grit-S scale.

Grit question 4: Can you describe a time when you worked on a project or skill for an extended period? How did you maintain your interest and focus?

There was only one response to grit question 4 that was assigned the pattern code defeated by barriers and challenges and the concept code not coming easily. The response came from a Group 1 participant.

Andrew Boyer of Group 1 answered:

> Describing his experience playing high school golf, he said, “I hit a plateau to where I wasn't getting any better in print. And to me, that felt like I was only getting worse. And it was kind of, like, embarrassing.”

Grit question 5: How do you handle situations where success doesn't come quickly or easily?

These were only two responses to the final grit question that were assigned pattern codes discouraged by failure and defeated by barriers and challenges.

Andrew Boyer of Group 1 answered:

When describing how he reacted when he had difficulty finding a job as a flight instructor, Andrew said: Six months I thought, okay, screw this, I got I wasted my money, wasted all my time, wasted the effort on getting a certificate that I can't even use. Otherwise, I'm just wasting time. And, you know, I did end up ultimately wasting six months because I did not have a job. In addition to his struggle finding a CFI job, Andrew described a class that he struggled to pass.

That was a calc class here. So, I enrolled in it twice. I withdrew it two times because I was like, I can't do this. I'm going to fail. I like my GPA, but I can't afford this. I got to fly. So, I just dropped that class. The first time I dropped it; I dropped it a weekend.

Harry ODonal of Group 2 answered:

So, the class I had last semester was called Mechanical Vibration. It's an upper-level engineering class, and at first, I walked in, and I had. I do not even know what the class was. I signed up for it because it was a part of my degree. And none of the material I saw, like everything was completely foreign.

The concept codes assigned to Andrew Boyer's response were difficulty dealing with failure and difficult classes. The concept code assigned to Harry ODonal's response was not coming easily. Again, the relatively small number of responses to grit question 5 that were assigned to these codes supports the quantitative results of the first phase of this study.

Comparative Analysis Theme three: Growth Mindset

In the first quantitative phase of this mixed methods study, participants answered the mindset questionnaire, and the data was analyzed using the T-Test: Two-Sample Assuming Unequal Variances to determine if the difference in growth mindset scores between the two groups of participants was significant.

The p-value in the two-tail t-test for both subscales was greater than 0.05. Therefore, there was no statistically significant difference between the mean scores of Growth Mindset Group 1 and Growth Mindset Group 2. As a result, the null hypothesis was not rejected: There was no difference in growth mindset scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another Aerospace concentration was not rejected.

The following comparative analysis of the qualitative data collected through semi-structured interviews focused on growth mindset. See Appendix A for the complete semi-structured interview protocol. In the following comparative analysis, answers to the growth mindset questions by participants in Group 1 and Group 2 were compared.

Mindset question 1: When you receive feedback or criticism, how do you typically respond?

When reviewing the following answers to this question, both groups seem to say that they try to learn from criticism, but most of the participants qualified their answers. For example, Andrew Boyer added: “I want to make sure they're educated and what they're giving me feedback on, because I could look at anybody and give them feedback over anything.”

Lester Doyle of Group 1 answered:

I guess it depends on how the feedback or criticism is delivered. But if it seems like it's genuine feedback criticism and they're trying to help me learn something, I'm usually open to receiving it.

Mike Walton of Group 1 answered:

I've just really started to focus on using any feedback, no matter what, even if it's judgmental, to help better and grow myself.

Mary Grady of Group 1 answered:

Well, I like to use criticism to help me improve. I try not to think of it as a negative thing. I like criticism because I get to get somebody else's perspective on what my weaknesses are and what I can, learn from that criticism. I used what the instructor told me about the feedback.

Jasper Banks of Group 2 answered:

Yeah. Criticism is tough. So, I would try to reevaluate myself and try to see things from their perspective.

Peter Carrier of Group 2 answered:

So, you know it's kind of a weird question. There's a sense you can learn, you can change. But honestly, I would like to kind of meet in middle ground where like if it's comfortable for me and still within reason, that'll work. It'll work. That's kind of how I think it.

Harry ODonal of Group 2 answered:

Knowing that there is some good faith without having that negative aspect around it to say, hey, this is exactly what you did wrong, then I know I can learn from that.

Matt Vanna of Group 2 answered:

Nobody likes to take criticism, but I've learned to accept it and run with it more after experiences.

Both Group 1 and Group 2 answered that they try to view criticism positively, but some said that their reaction to criticism depended on the source. So, pattern codes were mixed between positive and negative view of criticism. For example, Lester Doyle said, “I guess it depends on how the feedback or criticism is delivered.” So, the dominant answer was yes, I try to learn from feedback or criticism depending on how it is delivered and by whom. This supports the results of the quantitative first phase of this explanatory sequential mixed methods study which indicated that both Group 1 and Group 2 scored in the mid-range of the growth mindset scale.

Mindset question 2: How do you view mistakes or failures in your learning process?

The dominant pattern code for the following answers was learned from failure. Although some of the participants stated that they don’t like failure, all of them indicated that they try to learn from it.

Andrew Boyer of Group 1 answered:

I think they're necessary. I don't like them. I want to avoid them at all costs. But I do think they're necessary because sometimes the necessary things you're not learning can only be obtained through failure. Because, I mean, you know, you can always cheat your way through school or, you know, take the easy way out, but you're never going to learn.

Lester Doyle of Group 1 answered:

I think it's just part of the process. You know, you must fail sometimes to learn from it. And one thing I'm thinking is, stage checks and stuff in the pilot curriculum. Being able to find your weakness areas. I feel like it has been the best learning point for me. Those are the things I'll remember more later. When I get evaluated again and I get asked the same questions that I've been asked and failed before, I think it provides a better opportunity for learning whenever you do fail.

Mike Walton of Group 1 answered:

I view failures and mistakes as crucial learning moments. I always hated mistakes when I first came to school, anything less than a 95 destroyed me. I wanted perfection. Now I know that sometimes you've just got to fail to learn. Now, I know if I go up in a commercial flight or EOC or anything, I'm probably not going to go if the winds are gusting 20 knots. That’s not the smartest decision I can make. I should be better and have better personal minimums. So, anything, any mistakes I make is good to help me grow. Once again, it's all about personally growing your mind, your abilities, and just you as yourself every day.

Jasper Banks of Group 2 answered:

Well, if you're not making mistakes, you are not learning, I think that's one of the hardest things.

Harry ODonal of Group 2 answered:

I know that mistakes are natural. And those will be those will just happen as you go. Failures. Failure is a very strong word for me, as I define failure as not learning from your mistakes. So, if I failed an exam, for example. I don't really consider that failing. Unless later. You know, I have that topic, and I do not learn from me not getting a high score. So, I take failure very seriously. And the fact that whenever I do make a mistake, as everyone does, I make the best effort to learn from those. So, I do not fail.

There was not much of a difference between the answers of Group 1 and Group 2 which also supports the quantitative results of the first phase of this study which found that there was no significant difference in their growth mindset scores. For example, Mike Walton from Group 1 said that he hates making mistakes, but he views them as a learning moment. Jasper Banks of Group 2 said that if you are not making mistakes, you are not learning. These were both assigned to pattern code learned from failure.

Mindset question 3: Do you believe people can change their abilities and intelligence over time? Why or why not?

Again, participants of both Group 1 and Group 2 answered in the affirmative when asked if they believed that people could change their intelligence and abilities over time. This is consistent with the quantitative findings in the first phase of this study.

Andrew Boyer of Group 1 answered:

> Oh, that's a good one. I believe there's a huge difference in, you know, effort versus ability. But I believe that if you take somebody, if you take a sample of people who do not have a learning disability and they're all, it's a level playing field, I do believe that you can change that. But if you don't have any of those, I think that you can definitely make the change.

Lester Doyle of Group 1 answered:

> I would say so, yes. You just have to give it a chance and be open to the opportunity to learn from the process.

Mike Walton of Group 1 answered:

> Yes. I believe you can. When I was in high school, I was the type of person who never cared about school. I did good enough. I'm smart enough to get A's and B's, and that was enough to get by. All I was interested in was working. I never focused on school, never put in any effort. Until I really came to college and really proved to myself that I could grow and become a better version, just growing my intelligence. Anything is possible if you put work into it. Some people might learn faster, some people might have it a little bit easier,

but at the end of the day, if you put the work into it, whether it's longer or shorter than somebody else, you can grow your intelligence and be just as good as somebody else.

Mary Grady of Group 1 answered:

Yes. I do think intelligence can be changed. I don't think it's just like a set thing that you're born with. If you really work hard at it, you can become smarter, become quicker. Something. You know, you see it all the time. Just world examples. You see it all the time. So that's why I think you can. You can change it. Yes. When I do push myself to do things that I'm not comfortable with. And later, I realize, oh, I'm actually getting better at it, even if it's just a really slow progress. I do realize I am getting better at it.

Jasper Banks of Group 2 answered:

Yeah. I think anybody's willing to change or able to change. For me, intelligence is one thing, but I can judge somebody based on their effort. If you put in the effort and you at least attempt and try to learn, intelligence is going to come as part of that mixture.

Peter Carrier of Group 2 answered:

And you, even if you don't do good, you still have a little bit of intelligence from that experience alone as, like a new, like a base, like a benchmark kind of thing where you can build on top of that, even if it's not like ridiculously fast or something like that. You know, there's always a way for me to still learn them, even if it's just not the way everyone else does, you know? And that's kind of how I feel with like, intelligence is that, yes, you can improve and remember, and you know you'll keep growing very incrementally

Harry ODonal of Group 2 answered:

I'm not sure. I'm going to say yes. You want to say yes you can.

Matt Vanna of Group 2 answered:

I believe people can absolutely change their abilities and how they respond to things, but not with time. It comes with experiences. If you do the same thing over and over and over, you're only going to get the same output that you put in over and over and over. If it's only experiences that force you into a different spot, that change how you react or perceive things and cause the change for the better.

Answers from both Group 1 and Group 2 participants consistently expressed the belief that intelligence is not fixed and can be improved with time and effort which was consistent with the Phase 1 findings that there was no difference in growth mindset between the groups. For example, Mary Grady of Group 1 said that she does not believe that intelligence is innate, and with hard work, you can become smarter and quicker. Jasper Banks of Group 2 said that intelligence will come if you put in the effort. Both comments were assigned to the pattern code intelligence can be improved.

Mindset question 4: What do you think is more important: natural talent, or the effort and time you put into developing a skill? Please explain your reasoning.

The pattern code assigned to all the following comments indicated a belief that intelligence can be improved with concept codes of effort and time more important, talent not enough, intelligence not innate, always more to learn, and push beyond comfort zone.

Lester Doyle of Group 1 answered:

I would say, effort and time being, you know, being put into developing a skill or knowledge, because, you know, you can be naturally talented at these very specific things. But if you apply yourself to just about any area, I mean, you don't you may not be the best at it. But you can excel in your own way. As long as you provide yourself opportunities to grow as a person.

Mike Walton of Group 1 answered:

No matter what, it's always going to be the effort that you put in.

Mary Grady of Group 1 answered:

I think effort and time is more important. Natural talent. If you don't work on it, it might not improve. And it might just, like, stay. Just as some talent that you have. But if you really put in the effort and work ethic into something, you can continue improving and getting better and being even better at something than someone who had the natural talent for it.

Jasper Banks of Group 2 answered:

Well, just like I said, I think effort and time. Everybody learns at a different pace and everyone has raw talent. But, if somebody can put in their effort and time, they're going to see the results. And not only that but you can have the talent in something, a natural born talent and, and not use a lot of effort and just get by. But there is going to be a time when

you're going to face adversity, and that talent is not going to be enough to get you through it.

Peter Carrier of Group 2 answered:

I'm going to say putting in time and effort is more valuable because once you feel good about yourself. If you finally get over it, you feel good. And then that way it becomes natural. So, as I said, I think putting in time and effort is probably the better way, because you'll feel really, really, really good about yourself.

Harry ODonal of Group 2 answered:

It was effort and time. Effort and time. You sense you gained a sense of intense interest in the subject that really keeps you going. In terms of natural talent, sure. Like, growing up, I was just naturally good at math. That's something that always came to me very quickly. Students who also were good at math were a lot of times better than me. Quite frankly. But after spending all the time, the effort, the energy into learning more math at this point, I am now a lot more involved in that. So, trying to get an A by spending more time and more energy on something you're developing an intense, I guess, relationship with the subject. You get to understand this subject more and you'll eventually be much better than the people who are naturally good at that subject.

Matt Vanna of Group 2 answered:

I think effort is more important than having natural talent.

The codes assigned to both Group 1 and Group 2 were virtually identical and demonstrated that participant from both groups felt that intelligence is not present in an individual from birth. Although participants in both groups said that people with talent may learn faster, they all felt that the effort and time put in was more important. For example, Mary Grady of Group 1 said that even talented people will not improve without time and effort. Again, this supported the quantitative result of the first phase of this study which indicated that there was no significant difference in growth mindset between the groups and that both groups exhibited growth mindset with some fixed ideas.

Comparative Analysis Theme Four: Fixed Mindset

Participants of both Group 1 and Group 2 provided answers to the growth mindset questionnaire that were predominantly assigned pattern codes intelligence can be improved, learned from failure, and positive view of criticism. These pattern codes were all associated with Theme Three, Growth Mindset which supports the results of the quantitative first phase of this study which showed mid-range growth mindset scores for both groups and no significant difference between Group 1 and Group 2 in growth mindset scores.

Mindset question 1: When you receive feedback or criticism, how do you typically respond?

The pattern code assigned to all the following answers was negative view of criticism. Concept codes assigned were difficulty with negative criticism and ego problem.

Andrew Boyer of Group 1 answered:

> Sometimes I do find it hard to swallow my pride. I feel like that's a common thing for a lot of people, though. But typically, I like to make sure one, if I'm going to receive feedback

from somebody, I want to make sure they're educated and what they're giving me feedback on, because I could look at anybody and give them feedback over anything.

Lester Doyle of Group 1 answered:

But, you know, if it's more of a negative connotation and the deliverance of the feedback, I'm usually not as open. To take the criticism, but I may, more, in my mind, reject the criticism a little bit.

Mike Walton of Group 1 answered:

When I first came in, I didn't take it, feedback, very well because I had a pretty big ego. I thought I was good, I thought I was great, I thought I was amazing at everything

Jasper Banks of Group 2 answered:

Criticism can be a hard pill to swallow. Criticism is tough. But yeah, some of the criticisms are tough to deal with.

Harry ODonal of Group 2 answered:

A comment that is very extremely negative is very demoralizing.

The number of answers assigned to Theme Four pattern codes was low compared to the number of pattern codes associated with Theme Three which also supports the first phase results. Although the number of these codes was relatively low, some participants gave answers that were assigned both growth mindset and fixed mindset concept and pattern codes. Some participants gave answers that were assigned conflicting codes. For example, Andrew Boyer said that he sometimes finds it hard to swallow criticism, but also said he likes to learn things from criticism. This is consistent with the quantitative first phase results which indicated that both Group 1 and

Group 2 scored in the middle range of the growth mindset scale indicating growth mindset with some fixed ideas.

Mindset question 2: How do you view mistakes or failures in your learning process?

All answers were assigned concept codes difficulty dealing with failure and pattern code discouraged by failure. There were no other codes assigned to these answers.

Mary Grady of Group 1 answered:

Sometimes failures and mistakes do slow me down.

Peter Carrier of Group 2 answered:

Setbacks. That's all they really are. Like I said, I, I deal with a little bit differently, you know, probably for like a couple days, I'll be sulking and sleeping all day just trying to get over it. But, you know, setback's, a setback.

Matt Vanna of Group 1 answered:

I do tend to beat myself up about mistakes that I may call myself an idiot frequently, but like it's nothing that would really get you down. Like when I made the mistake on the check ride back in there, I had, like, back when I took the flight lab, I had very little accountability. I've had some experiences that have changed quite a bit. I blamed everything else for what happened. I blame the instructor. Everything under the sun except me because it was easy.

Although the answers to this question from both groups generally supported the theme of growth mindset, some admitted to struggling with challenges and having difficulty dealing with failure. For example, Peter Carrier of Group 2 admitted that it takes him a while to recover from a setback and Matt Vanna of Group 1 said that he blamed everything and everyone but himself for

failures in the past. There were relatively few answers to this question that demonstrated a fixed mindset which is consistent with the first phase of this mixed methods study that showed growth mindset with some fixed mindset ideas.

Mindset question 3: Do you believe people can change their abilities and intelligence over time? Why or why not?

All the following answers were assigned the pattern code intelligence is fixed. The concept codes assigned were differences in talent and some people think better.

Andrew Boyer of Group 1 answered:

> Like my brother, for example. It always came easily to him. But then when you look at it, he studied significantly more than me. He didn't play any sports. So that was kind of his thing. I still got good grades in high school, but I didn't have all these accolades and scholarships as he did. And then when I really look at it, you know, I've always said, it's just because he's smarter than me.

Peter Carrier of Group 2 answered:

> Yes, I don’t want to say no because there are some things that people are just naturally gifted at. Like, you know, maybe you're good at math, whereas there are people who aren't good at math like me. I'm terrible at math, but, you know, you keep trying, you stop, you still end up wherever you stop.

Harry ODonal of Group 2 answered:

> It really depends on the structure that you're given. So, everyone and in general, you know, at a younger age is probably around the same in different ways. They have their own

> interests. Some are better or some better at science, some math. But if you have a lot of teachers who are good in science, but a lot of teachers are bad in math. That means that more people might be more, you know, intellectually inclined towards science. So that's why I believe. Yes. I think it really depends on the people.

Again, some of the participants gave conflicting answers which is consistent with the quantitative first phase results indicating growth mindset with some fixed ideas. For example, Harry ODonal also said yes when asked if he believed that people can change their abilities and intelligence over time, but ended by saying it depends.

Mindset question 4: What do you think is more important: natural talent, or the effort and time you put into developing a skill? Please explain your reasoning.

Both of the following answers were assigned the concept code differences in talent and the pattern code intelligence is fixed.

Mike Walton of Group 1 answered:

> Natural talent comes with people, and you can be great.

Matt Vanna of Group 2 answered:

> Natural talent does make it a lot easier to keep going, because there's a lot of there's a lot less things to look at and worry about.

Once again, there were conflicting answers. For example, in addition to saying that some people have natural talent, Mike Walton also said, “No matter what, it’s always going to be the effort that you put in.” Matt Vanna also said he thinks effort is more important than having natural talent after saying that natural talent makes learning easier.

Final question 5: Is there anything else you would like to share about how you respond to challenges and your attitudes toward learning and intelligence?

This question was designed to capture any remaining thoughts about grit and growth mindset as it relates to the participants' educational experiences. Responses from both groups were similar in their beliefs about learning and intelligence as well as how they respond to barriers and challenges.

Lester Doyle of Group 1 answered:

> My thought is, you know, hindsight is twenty-twenty. You may make a mistake in the time and not realize it. Such as the example I gave being on deployment and kind of having a bad attitude throughout it. But looking back now, I feel like I've learned a lot and been able to look at mistakes and have takeaways from them. And I don't feel like any challenge is too large to overcome. I think persistence is the biggest thing with overcoming challenges.

Mike Walton of Group 1 answered:

> At the end of the day, no matter what, don't give up on the goal. There's going to be setbacks. And sometimes it's going to feel like the right thing to do is to quit. But as long as you keep going, you keep pushing forward and you claw. I live by the, the saying that they can fail me, but they can't get rid of me. They're going to have to force me out of this program, for me to quit. I'm not just going to walk away from it. I'm going to succeed however long it takes. If I can't graduate in eight years, I'll keep going eight years longer, I don't care. I will push until I get there. So, no matter what, just don't. Don't quit, all right? I've had challenges, but I keep going.

Mary Grady of Group 1 answered:

Well, when it comes to challenges and learning and stuff, I just like to keep going and see where it goes. I know that by the end of it, I'll become a better person for it. And giving up is just like accepting that failure, accepting just the, I don't know, just the baseline. I guess.

Peter Carrier of Group 2 answered:

I will never quit. I'll never back down. That's all you really need. And like, as well as intelligence, you know, just keep trying. Just don't give up. That's really what it is about. Even if you must learn a different way, it'll eventually come. Come around.

Harry ODonal of Group 2 answered:

I believe that a positive mindset is the best way to approach any challenge. You always want to maintain a positive attitude. You want to be around to either have people help you or have you help other people. A positive learning environment is critical to creating, just a yeah, it's critical for success. A good positive environment is critical for success. And the last thing is that being able to break problems into small pieces, that is where I see success.

Matt Vanna of Group 2 answered:

Like I said, I just try things differently. Try different experiences that you normally wouldn't have. That will force you to look around and have a better awareness of yourself and do what you can to try to help others that are in a similar position. Because if you look at them, you'll also be looking at yourself in a way. Flight lab and the training program that I did really teach me a lot about accountability. And looking at myself rather than putting

the blame on other things. That's probably the biggest lesson that I've learned at MTSU at this time.

Most of the answers to this question were assigned concept and pattern codes that indicated high grit and the belief that intelligence can be improved. Concept codes included learned from mistakes, effort and persistence, giving up is accepting failure, don't quit, breaking down tasks, and tenacity. Pattern codes assigned included learns from failure, overcoming barriers and challenges, and success strategies. Again, there was very little difference between Group 1 and Group 2. Examples include how Lester Doyle of Group 1 feels that he learned a lot and has been able to look at mistakes and have takeaways from them demonstrate a belief that intelligence is not fixed. Peter Carrier of Group 2 said that he will not give up even if it means taking a different route which demonstrates high grit through success strategies. Mike Walton of Group 1 demonstrated high grit through effort and persistence when he said that no matter what don't give up on the goal.

Comparative Analysis: Subtheme Internally Motivated

There were two sub-themes that emerged under the theme of high grit. In answer to questions concerning grit, both Group 1 and Group 2 participants described how they stayed motivated to complete long-term projects such as completing a flight lab. Some participants were internally motivated or self-motivated while others were more motivated by influences outside of themselves. Table 21 lists the concept and pattern codes that represent these two sub-themes of Internally Motivated and Externally Motivated. The following comparative analysis reviewed and compared the answers to each grit question that were assigned the pattern code internal motivator revealing how each group was motivated by different factors. These different motivational factors may further explain the differences in grit between Group 1 and Group 2.

Grit question 1: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated?

Andrew Boyer of Group 1 answered:

But additionally, it's something that I enjoy and I long for.

Mary Grady of Group 1 answered:

I don't know, focusing on myself, focusing on what I'm doing. Help me with that challenge of the competition and not worry about what other people were doing, or other students were doing, and stay motivated.

Peter Carrier of Group 2 answered:

Like I said, people deal with things differently. And like I said, I even failed my commercial check ride. So, I'm glad I did retake it. I'm glad I passed it the second time. Even if it wasn't the first time, I still got it done. I still feel good about it.

Andrew Boyer's answer was assigned the concept code passion for aviation and the pattern code internal motivator. The answer that Mary Grady gave was assigned the concept code focusing on self and the pattern code of internal motivator. Peter Carrier's answer was assigned the concept code motivated by progress and the pattern code internal motivator. All three participants described how they were internally motivated or self-motivated when pursuing their long-term goals.

Grit question 2: How do you usually respond when you encounter obstacles or setbacks while working toward a goal?

Lester Doyle of Group 1 answered:

I'd say I'm usually optimistic about things. I know there always seems to be some sort of solution. I don't think of myself as one to throw my hands in the air and say, there's nothing I can do about it. You know, I guess more try to find a solution to the problem.

Mary Grady of Group 1 answered:

So just a simple challenge was basically based on grades and competition as well. You know, there's of course, other students wanting to achieve that same goal. I don't know, focusing on myself, focusing on what I'm doing. Help me with that challenge of the competition and not worry about what other people were doing, or other students were doing and stay motivated. I think that was like my main motivating part and to make myself proud. So, I worked hard to accomplish that.

Harry ODonal of Group 2 answered:

I start brainstorming and get myself into that positive mindset.

Again, these answers were all assigned the pattern code internal motivator. Concept codes assigned included optimistic in solving problems and focusing on self. When encountering obstacles or setbacks, these participants were self-motivated when responding. In other words, they found motivation from within themselves rather than depending on outside factors such as family and friends.

Grit question 3: What keeps you going when you feel like giving up on something important to you?

Lester Doyle of Group 1 answered:

To the yeah, pride to myself and those around me because I put so much into this, you know, the whole reason I joined the military was to help fund it and kind of prepare me for the pilot route. I feel like everything that I've done, it's kind of helped try to have the intent of aiding me along that route, for sure.

Mike Walton of Group 1 answered:

As a kid, I always gave up on a lot of the things I said I was going to do. And as I grew older, I realized I didn't like being that person anymore. So, whenever I set goals, I always make sure that I stick to them no matter what. I remind myself of this any time I sit there and think, I don't want to do this anymore, I remind myself that I should and that I can't quit. I set myself to this goal. There's no going back. Once I'm in, I'm going all the way. The regrets of my past decisions? Okay. Regretting not completing things in the past.

Peter Carrier of Group 2 answered:

And honestly, another thing, too is that I know as a Christian, we're going to encounter a bunch of tough times and a bunch of tough challenges that God's going to give us. had I started, you know, looking back into getting into church. That helped me a lot too, because, you know, coincidentally, I got to go to a couple weeks where they're talking about like, resilience and faith. You know, don't give up on your faith.

These answers were assigned the pattern code internal motivator and concept codes proud and motivated by faith. Lester Doyle said that he relies on his pride to keep going when he feels like giving up on a long-term goal. Mike Walton remembers how he gave up on goals when he was younger and reminds himself that he doesn't want to be that person anymore. Peter Carrier falls back on his religious faith to keep himself motivated.

Grit question 4: Can you describe a time when you worked on a project or skill for an extended period? How did you maintain your interest and focus?

Andrew Boyer of Group 1 answered:

Okay. So, I was a competitive, amateur golfer in high school. Still love playing, but I just don't have time, like I used to. So, I started playing freshman year high school. I never played before. And then I fell in love with the process of getting better.

Jasper Banks of Group 2 answered:

Once you can see a little bit of progress, it's a snowball effect. And the hardest part is just getting to that starting point and starting work. Once you have just the smallest amount of progress, it starts to exponentially gain as you continue to go. So, I would just say, an overall grit and overall effort.

Harry ODonal of Group 2 answered:

It's really waking up each morning and seeing what's ahead and seeing what's next. What do I need to review? What can I get better at? Really trying to see the positive aspects and all of it. Because the more positive that you see, the more you'll want to continue doing it.

These answers were all assigned the pattern code internal motivator. The concept codes were motivated by progress and optimistic in solving problems. Andrew Boyer maintained interest in high school golf by falling in love with the process of getting better. He was motivated by progress. So was Jasper Banks and Harry ODonal.

Grit question 5: How do you handle situations where success doesn't come quickly or easily?

There were no answers to grit question 5 that were assigned the pattern code internal motivator.

Comparative Analysis: Subtheme Externally Motivated

The following comparative analysis reviewed and compared the answers to each grit question by Group 1 and Group 2 participants that were assigned the pattern code external motivator. Differences between the groups were analyzed to clarify and explain the results of the first quantitative phase which determined that Group 1 was significantly higher in grit than Group 2.

Grit question 1: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated?

Andrew Boyer of Group 1 answered:

> This might sound bad is the one of the main motivators is obviously to get to the airline job to get the healthy salary, to pay off the student loans. But it's also seeing my peers that have gone on to accomplish the same goal that I have seeing them. And then it's kind of like, oh, it's possible I can do that.

Jasper Banks of Group 2 answered:

A backbone of mine was my family. My wife kept me motivated.

Peter Carrier of Group 2 answered:

But the only reason why I did get back up was because I had a lot of friends who cared about me and helped push me towards my goal. I even failed my commercial check ride. That was a huge blow, but I still had my friends push me towards getting it regardless of anything that would happen. I'm more of an extrovert. So, like a lot of the things depend on how I guess the room reads. So, you know, everyone that are all like, hey, you know, you got it, you got it.

All these answers to grit question 1 were assigned the pattern code external motivator. Andrew Boyer said that he stays motivated by the potential earnings of an airline pilot to pay off his student loans. He is also motivated by seeing his peers go on to successful careers in aviation. Both Jasper Banks and Peter Carrier heavily rely on family and friends to stay motivated rather than self-motivation.

Grit question 2: How do you usually respond when you encounter obstacles or setbacks while working toward a goal?

Andrew Boyer of Group 1 answered:

So again, I'm finding that common ground with somebody, it makes me know that I'm not the only one. And when I find comfort in knowing that I'm not the only one dealing with this, it makes it a lot easier for me to get through an obstacle.

Peter Carrier of Group 2 answered:

Like I said, I have people that I surround myself that love me and cherish me, and then they'll help me get going as well. That helps me get going a little bit faster than I would do by myself. So, like I said, I would give it a lot to them.

These answers to grit question 2 were all assigned the pattern code external motivator. Andrew Boyer responds to setbacks by remembering that his peers have also experienced setbacks. So, there is comfort in knowing he is not the only one. Peter Carrier responded to setbacks by turning to family and friends who support him.

Grit question 3: What keeps you going when you feel like giving up on something important to you?

Lester Doyle of Group 1 answered:

I am married. And so, my wife's been kind of pushing me along and kind of rooting for me the whole time.

Jasper Banks of Group 2 answered:

My family. I really have it in the forefront of my mind, and I don't want to let them down. So, I want to make my family proud. So that's always a driving factor.

Peter Carrier of Group 2 answered:

As I said, my friends, my family, my mom. I know she'd be let down if I gave up and stopped trying. So, I think about that a lot. I know my grandmother before she passed away, you know, she'd always be like, oh, you know, you just got to keep trying. Some things don't work out all the time.

Harry ODonal of Group 2 answered:

Really, that other people believe in you. Whether it be family, or sometimes even faculty that are saying you're right there, you're this close like, maybe it's even students. So, it's really having other people to help motivate me and other people believing that I can do so.

Matt Vanna of Group 2 answered:

It just needs to be done. If I don't do it, then there are consequences. Yeah. Okay. I think they call that, like negative reinforcement in it.

A pattern began to appear with the answers to grit question 3. Most answers to this question that were assigned the pattern code external motivator were from Group 2 participants except for Lester Doyle. The external motivator for Jasper Banks and Peter Carrier was a fear of letting people down. Harry ODonal said that he is motivated to persevere by people who believe in him. Matt Vanna keeps going because he fears the negative consequences of giving up on something important to him.

Grit question 4: Can you describe a time when you worked on a project or skill for an extended period? How did you maintain your interest and focus?

There were no answers to this question that were assigned the pattern code of external motivator.

Grit question 5: How do you handle situations where success doesn't come quickly or easily?

Andrew Boyer of Group 1 answered:

I sort of talked to others and tried to educate myself further and try and find a more realistic expectation.

Harry ODonal of Group 2 answered:

I saw a lot of my fellow students also struggling with this. So, I ended up teaching a lot of my students or a lot of fellow students. This or topics within this course, which helped me understand the course more.

When success doesn't come quickly or easily, Andrew Boyer finds that seeking advice from peers and educating himself motivates him to keep striving. When Harry ODonal is faced with this situation, he would work with his peers.

Summary

This chapter described the results of the grit and growth mindset surveys in the first quantitative phase of this explanatory sequential mixed-methods study and the findings of the second qualitative phase. The design is called explanatory and sequential because the qualitative data was collected and analyzed after the quantitative data collection and analysis to explain the quantitative results in more detail. The purpose of the first quantitative phase of this study was to determine the difference in grit and growth mindset scores between students who enroll and eventually graduate in a collegiate professional pilot program and students who enroll in a collegiate professional pilot program but graduate in another concentration. The second qualitative phase aimed to provide clarification and explanation of the results of the first quantitative phase.

A total of 250 Aerospace students answered questionnaires on Qualtrics in the first quantitative phase of this study. These questionnaires were designed to measure individual grit and growth mindset scores. Descriptive and inferential statistics were generated with Excel statistical software which determined that there was a statistically significant difference between the grit scores of students who enrolled in and intend to graduate in the MTSU Professional Pilot concentration and students who enrolled in the MTSU Professional Pilot concentration but intend to graduate in another Aerospace concentration. The same statistical analysis was performed on growth mindset scores which did not find a statistically significant difference.

In the second phase of this study, qualitative data was collected through semi-structured interviews with a purposeful sample of 8 participants who previously completed the Grit-S and Mindset instruments and met the criteria for the purposeful sample. Four participants in the qualitative study were Aerospace students who enrolled in and intend to graduate from the Professional Pilot concentration. The remaining four participants were Aerospace students who had enrolled in the Professional Pilot concentration but had eventually switched to another Aerospace concentration. The semi-structured interview protocol was designed with open-ended questions to identify differences in the participants' educational experiences with long-term projects as well as their attitudes about intelligence and learning. The interviews were recorded, transcribed, edited, and cleaned for clarity. In the first cycle of coding, concept codes were assigned to the transcripts. Second cycle coding involved assigning pattern codes and looking for themes. A within group analysis was done concerning the themes High Grit, Low Grit, Growth Mindset, and Fixed Mindset and the two sub-themes Internally Motivated and Externally Motivated. Then a comparative analysis was presented concerning the same themes and subthemes.

The results of this study found that MTSU Aerospace students who enrolled and stayed in the Professional Pilot concentration scored significantly higher in grit than students who eventually switched to another Aerospace concentration. Although this study found a significant difference in grit between the two groups, both groups scored higher in grit than the population ages 25-34 (Duckworth and Quinn, 2009). In addition, this study found no difference in growth mindset scores between these groups. However, both groups scored in the upper mid-range of scores which signify a growth mindset with some fixed ideas (Dweck, 2016). An unexpected result of the qualitative second phase of this mixed methods study was a difference in how each group stayed motivated in pursuit of long-term goals. Students who enrolled and stayed in the professional pilot concentration were more self-motivated than students who enrolled in the professional pilot concentration and subsequently switched to one of the other Aerospace concentrations.

CHAPTER V: DISCUSSION AND RECOMMENDATIONS

Introduction

Duckworth et al. (2007) defined grit as perseverance and passion for long-term goals, and Dweck (2016) defined growth mindset as the belief that intelligence can be developed and is not fixed. The goal of this research was to determine if students who enroll in and eventually graduate from a collegiate professional pilot program differ in grit and growth mindset from students who enroll in a collegiate professional pilot program but graduate in another discipline. This research also investigated the differences between these two groups of students in their personal and educational experiences. If these traits are related to persistence in a collegiate professional pilot program, they could be taught to prospective student pilots, and it may help increase the number of students who successfully graduate from these programs

The design of this research was an explanatory sequential mixed-methods design. The first phase of this research study involved quantitative data collection and analysis. The second phase involved qualitative data collection and analysis to clarify and explain the results of the first phase quantitative analysis. The quantitative data in the first phase of this study was collected through surveys to measure grit and growth mindset in two groups of Aerospace students at Middle Tennessee State University

The qualitative data in the second phase of this study was collected through semi-structured interviews with a purposeful sample of eight students who completed the survey in the first phase. Four participants were Aerospace students who initially enrolled and intend to graduate in the MTSU Professional Pilot concentration, and four participants were Aerospace students who initially enrolled in the MTSU Professional Pilot concentration but intend to graduate in another

Aerospace concentration. The interviews were conducted on the Zoom platform and recorded with the permission of each participant. After the recordings were uploaded to Adobe Premier Pro for automatic transcription, the recordings were destroyed. The transcriptions were edited, cleaned, and sent to each participant to review for accuracy. Next the transcriptions were uploaded to dedoose qualitative research coding software, segmented into meaningful analytical units, and first stage coding was completed. Second stage coding was done in search of patterns, themes, and subthemes to answer the third research question. The rest of this chapter will present a discussion of the findings and recommendations for future research and practice.

Discussion of Findings

Phase 1 Quantitative Findings

The first phase of this explanatory sequential mixed-methods study was focused on quantitative data collected from volunteer Aerospace students at Middle Tennessee State University who initially enrolled in the Professional Pilot program. Participants completed the Grit-S scale and Growth Mindset questionnaire which were administered using Qualtrics. In addition to the Grit-S and Growth Mindset instruments, participants were asked to complete a short survey to determine class standing, initial Aerospace concentration, and Aerospace concentration in which they plan to graduate. Phase 1 of this study was designed to answer the first two research questions and test the associated hypotheses.

Analysis of Grit-S Scores

Participants completed the Grit-S scale on Qualtrics, and Grit-S scores were calculated and uploaded into an Excel spreadsheet. Excel statistical software was used to generate descriptive and inferential statistics for Group 1 and Group 2. Grit-S scores can range from 1 (not at all gritty) to

5 (extremely gritty). The mean Grit-S score for Group 1 was 3.60513245 with a standard deviation of 0.526801021 and the mean Grit-S score for Group 2 was 3.408653846 with a standard deviation of 0.522247326. To answer the first research question and test the corresponding null and alternative hypotheses, this data was analyzed with a T-Test: Two Sample Assuming Unequal Variances to determine if the difference in grit scores between Group 1 and Group 2 was significant.

A two-sample t-test was conducted comparing the mean Grit scores of Group 1 (mean = 3.60513245, SD = 0.526801021) and Group 2 (mean = 3.408653846, SD = 0.522247326). The p-value in the two-tail t-test was less than 0.05 (see Table 9). Therefore, the difference in mean Grit scores between Group 1 and Group 2 was statistically significant. Null Hypothesis 1 was therefore rejected and alternative hypothesis 1 was accepted. There was a difference in Grit between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration but switched to another Aerospace concentration. Grit-S scores of students in Group 1 were significantly higher than the Grit-S scores of students in Group 2. This finding is supported by several studies including Reysen et al. (2019) who found that academically at-risk students scored significantly lower in grit than students who were not at risk at the University of Mississippi and Christopoulou et al. (2018) who found a positive relationship between grit and academic performance in a review of 29 studies that investigated the association of grit with positive educational outcomes. These results support the theory that students who score high in Grit-S are more likely to succeed and persist in a collegiate professional pilot program.

Analysis of Growth Mindset Scores

Growth Mindset is measured with two separate subscales known as intelligence and character. Participants completed the Growth Mindset questionnaire on Qualtrics, and separate scores were calculated for the intelligence subscale and the character subscale. Excel statistical software was used to generate descriptive and inferential statistics for Group 1 and Group 2. The mean score for the intelligence subscale for Group 1 was 11.70198675 with a standard deviation of 2.328933095 and the mean score for the intelligence subscale for Group 2 was 12.21153846 with a standard deviation of 2.483960614. The mean score for the growth mindset character subscale for Group 1 was 11.66887417 with a standard deviation of 1.798969536 and the mean score for the growth mindset character subscale for Group 2 was 11.76923077 with a standard deviation of 1.86416553. Both Group 1 and Group 2 exhibited a growth mindset with some fixed ideas on both the intelligence subscale and the character subscale.

To answer the second research question and test the corresponding null and alternative hypotheses, this data was analyzed with a T-Test: Two Sample Assuming Unequal Variances to determine if the difference between Growth Mindset Character Subscale scores and Growth Mindset Intelligence Subscale scores between Group 1 and Group 2 were significant. A two-sample t-test was conducted comparing the mean scores of Group 1 Intelligence Subscale (mean = 11.70198675, SD = 2.328933095) and Group 2 Intelligence Subscale (mean = 12.21153846, SD = 2.483960614). A separate two-sample t-test was conducted on the mean scores of the Group 1 Character Subscale (mean = 11.66887417, SD = 1.798969536) and Group 2 Character Subscale (mean = 11.76923077, SD = 1.86416553). The p-value in the two-tail t-test for both subscales was greater than 0.05. Therefore, the null hypothesis was not rejected. There was no significant difference in growth mindset scores between students who initially enrolled and stayed in the

Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration but switched to another Aerospace concentration. This result is inconsistent with the findings of Claro et al. (2016) who found a strong relationship between growth mindset and academic achievement in Chilean 10th grade students and Dweck (2016) who found that students just entering junior high school who scored high in growth mindset experienced an increase in their grades. When Yeager and Dweck (2020) reviewed different studies that were unable to replicate results demonstrating the association of growth mindset with academic achievement, their results were inconclusive. However, results of another study may provide an explanation. According to Limeri et al. (2020a), the mindset scale was developed by Dweck (2016) to measure mindset in elementary school children. Since then, it has been used to measure mindset in post-secondary students without being validated. Process validity is defined as "a common set of cognitive processes when responding to items" (Limeri et al., 2020a, p. 2). The items in the mindset scale use the word intelligence. So, process validity would demonstrate that the term intelligence is defined consistently by post-secondary students. Limeri et al. (2020a) found that post-secondary students define intelligence inconsistently which may provide an explanation for the insignificant difference between the mindset scores of Group 1 and Group 2.

Summary of Phase 1 Findings

The first research question was answered in the affirmative. The analysis found a significant difference in Grit-S scores between the two groups. According to Table 22, the mean Grit-S score of Group 1 was above the total population mean of 3.4, and the mean Grit-S score of Group 2 was the same as the total population mean.

Although age data was not collected by the demographic questionnaire, it is safe to assume that most participants in Phase 1 of this study were under 35 years of age. For the population ages

25-34, the mean Grit-S score was 3.2 according to Duckworth and Quinn (2009). The mean Grit-S scores for Group 1 and Group 2 were 3.60513245 and 3.408653846 respectively. Both scored significantly above the population average for this age group.

Table 22

Population Averages Reported by Duckworth and Quinn (2009)

Group	Consistency of interest	Perseverance of effort	Total Grit-S score
Age 25-34	2.9	3.6	3.2
Age 35-44	2.8	3.6	3.2
Age 45-54	3.0	3.8	3.4
Age 55-64	3.1	3.9	3.5
Age 65+	3.4	4.0	3.7
Total Sample	2.9	3.7	3.4

(Duckworth & Quinn, 2009)

In addition to the analysis of Grit-S scores in Phase 1 of this study, a T-Test: Two Sample Assuming Unequal Variances of growth mindset scores determined that there was no significant difference in growth mindset between Group 1 and Group 2. The mean score on both the intelligence and character subscales for both Group 1 and Group 2 signified a growth mindset with some fixed ideas. Therefore, neither Group 1 nor Group 2 believed exclusively that intelligence can be improved, or that intelligence is fixed.

Phase 2 Qualitative Findings

In the second qualitative phase of this mixed methods study, the answers to the grit questions in the semi-structured interview provided by Group 1 were focused on how they managed to overcome barriers and challenges that threatened to prevent them from achieving their goals. The answers to the grit questions provided by Group 2 were more focused on developing success strategies that would help them achieve their goals. Group 1 participants were more likely to relate success to effort and persistence which was consistent with the quantitative results in the first phase of this study that confirmed Grit scores for Group 1 were significantly higher than Grit scores for Group 2.

Figure 13 and Figure 14 below are packed code clouds generated by dedoose, the qualitative research coding software that was used to help with the coding process and efficiently organize, manage, and analyze the transcript data. Figure 13 is the packed code cloud generated for Group 1, and Figure 14 was generated for Group 2. These packed code clouds give an overview of which concepts and themes were central to the second qualitative phase of this study. The larger the font in the packed code cloud, the more prominent the code was in this study.

These packed code clouds present a picture of the concepts and themes that were central to the second qualitative phase of this study. Before proceeding with the discussion of the Phase 2 qualitative results, it is worth noting the differences between the packed code clouds for Group 1 and Group 2. Most of the prominent codes for both groups represent the themes of high grit and growth mindset. However, within each theme, there are interesting differences.

The most prominent codes for Group 1 according to Figure 13 were overcoming barriers and challenges, intelligence can be improved, internal motivator, success strategies, and

discouraged by failure. Table 23 is a listing of the most prominent codes with the corresponding themes and subthemes that are pictured in the packed code cloud in Figure 13. The listing is from most to least prominent.

Figure 13

Group 1 Code Cloud

Table 23

Group 1 Most Prominent Codes from Packed Code Cloud

Order	Codes	Themes/Sub-Themes
1	Overcoming Barriers & Challenges	High Grit
2	Intelligence Can Be Improved	Growth Mindset
3	Internal Motivator	High Grit/Internally Motivated
4	Success Strategies	High Grit
5	Discouraged by Failure	Low Grit

According to Figure 14, the most prominent codes for Group 2 were success strategies, overcoming barriers and challenges, external motivator, internal motivator, and intelligence can be improved. Table 24 is a listing of the most prominent codes, themes and subthemes for Group 2.

Figure 14

Group 2 Code Cloud

Table 24

Group 2 Most Prominent Codes from Packed Code Cloud

	Codes	Themes/Sub-Themes
1	Success Strategies	High Grit
2	Overcoming Barriers & Challenges	High Grit
3	External Motivator	High Grit/Externally Motivated
4	Internal Motivator	High Grit/Internally Motivated
5	Intelligence Can Be Improved	Growth Mindset

Table 25

External and Internal Motivator with Concept Codes and Definitions

Pattern Code	**External Motivator**	**Motivated by outside influence**
Concept Code	Fear of Being Wrong	Afraid of making a mistake in front of peers
Concept Code	Fear of Letting People Down	Motivated by fear of letting down family or friends
Concept Code	Motivated by Negative Consequences	Fear of failure is motivating
Concept Code	Peer Advice	Talking to peers is motivating
Concept Code	Peer Failures	Comfort knowing that peers have struggled too.
Concept Code	Peer success	Motivated by success of peers
Concept Code	Potential Earnings	Motivated by the high earning potential of a professional pilot
Concept Code	Pushed by Family or Friends	Family or friends are major external motivator
Pattern Code	**Internal Motivator**	**Self-motivated**
Concept Code	Focusing on self	Focused on self rather than competition
Concept Code	Long-Term Goal Professional Pilot	Student's long-term goal is pro pilot
Concept Code	Motivated by Faith	Religious faith helps motivate me to succeed
Concept Code	Motivated by Progress	Motivated by seeing progress being made
Concept Code	Optimism in solving problems	Does not let problems influence optimism
Concept Code	Other long-term goal	Student's long-term goal is not pro pilot
Concept Code	Passion for Aviation	Primary motivator is a passion and enjoyment for aviation
Concept Code	Past Regrets	Motivated by failures in the past
Concept Code	Proud	Pride is an internal motivator
Concept Code	Work for airline	Student's long-term goal is working for an airline

In addition to the main themes, two subthemes emerged from the main theme of high grit. Group 1 was more internally motivated than Group 2. Participants in Group 2 were much more likely to name external sources of motivation such as friends, family, and peers. Participants in Group 1 were more likely to rely on internal sources of motivation such as pride and optimism. A list of these codes and their definitions can be seen in Table 25.

Finally, the packed code cloud for both Group 1 and Group 2 included the pattern code intelligence can be improved which falls under the growth mindset theme, but this pattern code was more prominent for Group 1 than for Group 2. This indicates a greater tendency for participants in Group 1 to believe that intelligence is not fixed and can be improved with time and effort. Although the first phase quantitative results did not reveal a significant difference in growth mindset scores, Group 2 growth mindset scores were slightly higher than growth mindset scores for Group 1.

The second qualitative phase of this mixed-methods study was designed to clarify and explain the quantitative results in the first phase of the study and answer the third research question: What are the differences between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? The following is a summary of the comparative analysis of Group 1 and Group 2 concerning the themes and subthemes revealed during second cycle coding. The focus of this summary is on the differences between Group 1 and Group 2 in how they approach long-term projects, how they handle challenges and setbacks, how they stay motivated despite challenges and setbacks, and their attitudes and beliefs about intelligence.

Theme One: High Grit

The first question in the semi-structured interview was: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated? In the comparative analysis in Chapter 4, answers to this question from Andrew Boyer and Mike Walton of Group 1 were compared to answers from Jasper Banks and Peter Carrier of Group 2. Both Andrew and Mike stated that their long-term goal was to become an airline pilot. Jasper's goal was to earn his bachelor's degree in Unmanned Aircraft Systems. Peter stated that he is still pursuing the goal of becoming an airline pilot even though he is no longer enrolled in the Professional Pilot concentration.

When asked about how he responds to barriers and challenges when pursuing his long-term goal, Andrew answered: "So, honestly, I coped with it by laughing at it. Kind of making jokes. Oh, one of these days, I'm going to come back and look at this and laugh at it." This statement was coded with the concept code humor and the pattern code overcoming barriers and challenges. Mike said that he stays motivated by continuing to push and train. He added: "Train the mind and overcome the difficulties. Nothing is impossible if I push and continue to try as hard as I can." Concept codes assigned to these statements included effort and persistence and train the mind. The pattern code assigned to both statements was overcoming barriers and challenges.

Jasper of Group 2 answered this question by explaining that one of his highest goals was to become a pilot, but he was unable to attain that goal due to issues with his FAA medical certificate. He continued: "But I circumnavigated and found myself applying for the unmanned aerial systems major which does not require a flight medical." This statement was assigned the concept code tenacity and the pattern code success strategies. Peter from Group 2 said that his goal of becoming an airline pilot was still ongoing. He said: "I switched and ended up at dispatch. The

Table 26

Overcoming Barriers & Challenges & Success Strategies with Concept Codes and Definitions

Pattern Code	**Overcoming Barriers & Challenges**	**Barriers or challenges do not defeat**
Concept Code	Ask for Help	Dealing with difficulties by asking for help
Concept Code	Don't quit	Persistence to achieve goals in face of challenges
Concept Code	Effort & Persistence	Effort & persistence is most important for success
Concept Code	Giving up is accepting failure	Persistence will lead to success
Concept Code	Humor	Dealing with difficulties with humor
Concept Code	Overcame financial challenge	Students were not defeated by cost
Concept Code	Patience & Trust	Patience and trust in process
Concept Code	Research	Overcoming barriers and challenges by researching solutions
Concept Code	Sticking to plan	Persistence to achieve long'-'term goal
Concept Code	Train the Mind	Training the mind to overcome difficulties
Pattern Code	**Success Strategies**	**Developed strategies for success**
Concept Code	Be Proactive	Getting tasks done ahead of schedule instead of procrastinating
Concept Code	Breaking Down Tasks	Breaking down a big project into smaller chunks
Concept Code	Change Concentration	Continued to pursue nonflying degree
Concept Code	Have Fun	You need to have some fun to get reinspired
Concept Code	Learned from Related Experience	Students tried to learn and apply knowledge from related experiences
Concept Code	Setting Goal	Setting short term goals
Concept Code	Setting High Goal	Setting an unrealistically high goal
Concept Code	Taking a Break	Took a break to re-evaluate goal
Concept Code	Tenacity	Explore different ways to learn
Concept Code	Understanding vs Memorizing	Trying to understand material rather than just memorizing
Concept Code	Visualization	Motivated by visualizing future life in aviation

biggest thing is that I think a lot of it was on me and just my unpreparedness." The concept codes assigned to these statements were changed concentration and barrier to achieving goal. The pattern codes were success strategies and defeated by barriers and challenges.

A comparison Group 1 and Group 2 answers to this question reveals a difference that will repeat itself throughout this comparative analysis. The prominent pattern code assigned to Group 1 answers was overcoming barriers and challenges, and the prominent pattern code for Group 2 was success strategies. Although these pattern codes fell under the theme of high grit, the concept codes underlying these pattern codes are fundamentally different. Refer to Table 26 for a list of concept codes for pattern codes success strategies and overcoming barriers and challenges.

Examples of some of the concept codes under the pattern code overcoming barriers and challenges include don't quit, effort and persistence, sticking to plan, and giving up is accepting failure. Concept codes under the pattern code success strategies include be proactive, change concentration, taking a break, and tenacity. The concept codes under overcoming barriers and challenges symbolize persistence and the inner strength to stick to a plan no matter what. Success strategies are more about the ability to be flexible and creative in reaching a goal. This is consistent with the two-sample t-test conducted in the first phase of this study comparing the mean Grit scores of Group 1 and Group 2. The p-value in the two-tail t-test was less than 0.05 (see Table 9). Grit-S scores of students who initially enrolled and stayed in the Professional Pilot concentration were significantly higher than the Grit-S scores of students who initially enrolled in the Professional Pilot concentration and eventually switched to another Aerospace concentration.

The second question concerning grit was: How do you usually respond when you encounter obstacles of setbacks while working toward a goal? When comparing answers to this question from

participants in Group 1 and Group 2, a similar pattern emerged. Andrew Boyer of Group 1 described what he did after becoming frustrated with his flight instructors.

> That's not going to get it done by just ignoring the problem. So, I did some more research, found a younger instructor that our personalities kind of mashed up with more, got in touch, in contact with him. And then before we even flew, we kind of talked about all the conflicts that I've been through. And he said that, you know, that he had gone through similar things.

When describing how he reacted after failing his commercial pilot check ride, Mike Walton of Group 1 said,

> Because I know I'm capable. These setbacks, they push me down and try to trick me into thinking I can't do it. But at the end of the day, as long as I work hard and continue practicing and continue doing the procedures that everybody's taught me throughout my educational career, I know I can overcome it."

Jasper Banks of Group 2 described his reaction to losing his FAA medical certificate. He said, "So, when I saw outside counseling resources through MTSU, I was able to understand that I needed to take a break." Peter Carrier of Group 2 said, "Well, sometimes I just take a step back, you know, like with my commercial failure."

Again, the prominent pattern code assigned to Group 1 answers was overcoming barriers and challenges, and the prominent pattern code for Group 2 was success strategies. Group 1 statements describe how barriers and challenges were approached by taking control of the situation. Group 2 statements described how students took a break and stepped back after a failure to buy time and figure out a success strategy.

Question 3 asked participants about how they keep going when they feel like giving up on something important to them. Andrew Boyer of Group 1 stated that he tries to remind himself about what it will be like when he achieves his goal of becoming an airline pilot. For example, after he failed his commercial pilot check ride, he drove to the Nashville International Airport to watch planes take off and land. Lester Doyle of Group 1 said that pride is what keeps him going when he feels like giving up. Mike Walton of Group 1 was motivated by his past. When he was young, he gave up easily on goals that he set for himself, and he no longer wanted to be like that. Mary Grady of Group 1 simply stated that the thought that she doesn't want to fail keeps her going. Group 2 participants answered this question with a slightly different emphasis. Jasper Banks of Group 2 said that it is his family that keeps him going. Peter Carrier said that he didn't want to let down his friends and his family, and Harry ODonal of Group 2 said, "Really that other people believe in you." These answers begin to reflect the subthemes of internally and externally motivated. Although pattern codes assigned to these answers included success strategies and overcoming barriers and challenges, Group 1 participants were more inwardly or self-motivated. Group 2 participants were motivated by forces outside of themselves such as friends, family, and faculty.

The fourth question in the semi-structured interview asked participants to describe a time when they worked on a project or skill for an extended period and how they maintained interest and focus. Andrew Boyer of Group 1 said that he sets high goals that he will never be able to achieve. Mike Walton of Group 1 said, "What I learned was at the end of the day, I'll finish it." Mary Grady of Group 1 said that it is her interest in Aerospace and her desire to keep improving. Jasper Banks of Group 2 answered that he looks for signs of progress. He said, "And once you can see a little progress, it's a snowball effect." Harry ODonal of Group 2 said that he tried to see the

positive aspects because the more positive that is seen, the more motivated he becomes to continue working. This question elicited a variety of concept codes and pattern codes. Most were related to the pattern code success strategies since the question was about how participants maintain interest and focus, but there were exceptions. Mary Grady's answer was assigned the concept code effort and persistence and the pattern code overcoming barriers and challenges. Harry ODonal's response was assigned the concept code optimistic in solving problems and the pattern code internal motivator.

The fifth grit question asked: How do you handle situations where success doesn't come quickly or easily? Andrew Boyer of Group 1 described his struggle to find a CFI job. He said, "I knew I had to get it done to progress." Lester Doyle of Group 1 said that the private pilot and instrument labs were slow going. He said, "Okay, but, yeah, just sticking to it and knowing that you know." Mary Grady of Group 1 described how she struggled with giving speeches in her communications class. She said, "I had to put myself out there a lot." Peter Carrier of Group 2 said, "I just told myself it's got to be done. I just kind of tell myself that, you know, don't give up that easily." Harry ODonal of Group 2 described his experience in a science class that was challenging. He said, "It's all about trusting that you can just take one step at a time. And as long as you're taking those steps forward and keeping a good attitude, then you will achieve your goal." The predominant concept codes assigned to these answers included effort and persistence, don't quit, and sticking to a plan with the pattern code overcoming barriers and challenges. The most common pattern code for Group 1 participants was overcoming barriers and challenges, and for Group 2 participants the pattern code success strategies was predominant. Both pattern codes fell under the theme high grit providing support for the high grit scores for both groups. In addition, the concept code effort and persistence appeared more often for Group 1 participants which

provided support for the quantitative results that confirmed significantly higher grit scores for Group 1 participants.

The conceptual framework employed in this study relating to grit was the OPAH model proposed by Datu (2021). OPAH stands for the optimal performance and health model of grit. See Figure 1 for the illustration of how grit affects achievement and wellbeing. This model shows how grit affects performance and wellbeing though effort, resourcefulness, motivation, needs satisfaction, emotional regulation, and positive cognition. Harry ODonal's remark about how seeing positive signs of progress helps keep him motivated to continue pursuing his goal is an example of positive cognition. Many of the answers to the first five grit questions in the semi-structured interview demonstrated how grit results in high achievement and a sense of wellbeing through effort, resourcefulness, and positive cognitions. This is consistent with Reysen et al. (2019) who found that academically at-risk college students scored lower in grit than college students who were not academically at-risk. This is also consistent with Miller-Matero et al. (2018) who found that grit scores were higher for medical students who completed in 4 years compared to students who completed in 5 years. Although not in the top five, one of the most prominent codes for Group 1 was effort and persistence. This is reflected in Mike Walton's answer when asked how he responds to barriers and challenges, he said that he stays motivated by continuing to push and train. He added: "Train the mind and overcome the difficulties. Nothing is impossible if I push and continue to try as hard as I can."

Theme Two: Low Grit

The first quantitative phase of this mixed-methods study confirmed that both Group 1 and Group 2 participants scored higher in grit than the population at large. See Table 22 for the population averages reported by Duckworth and Quinn (2009). The mean population grit score for

ages 25-34 was 3.2. The mean grit scores for Group 1 and Group 2 were 3.6 and 3.4 respectively. Answers to the first five grit questions in the semi-structured interview support high grit in both groups. Answers that reflected low grit were few and far between.

The first grit question asked: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated? Andrew Boyer of Group 1 described how he felt after failing his first commercial pilot check ride. He said, “I thought my life was over.” When describing his flight training experience, Peter Carrier of Group 2 said, “And like I said, it was rocky.” Although these responses were assigned concept codes that included barrier to achieving goal and not coming easily which both fell under the pattern code defeated by barriers and challenges, they were usually followed by comments that were assigned codes that fell under the high grit theme.

The second grit question was: How do you usually respond when you encounter obstacles or setbacks while working toward a goal? Again, there were only three comments that were assigned codes that fell under the theme of low grit. For example, when describing the barriers he faced getting his Private Pilot certificate, Andrew Boyer of Group 1 said, “I quit. I quit for 6 months. I was frustrated, I was like, well this is impossible. I’m never going to get this done.” Mike Walton of Group 1 described how he felt after failing his commercial pilot EOC (end of course). He said, “So, it set me back a lot. That really destroyed my confidence.” Jasper Banks of Group 2 said that he experienced “motivated burnout.” Concept codes assigned to these answers included difficulty dealing with failure, burn out, and failures slow me down. Pattern codes included discouraged by failure and defeated by barriers and challenges. The first phase quantitative results that confirmed high grit in both groups was supported by the relatively small number of responses that fell under the second theme of low grit.

The third grit question was: What keeps you going when you feel like giving up on something important to you. None of the answers to this question from either Group 1 or Group 2 were assigned codes that fell under the low grit theme. Again, this supports the first phase quantitative results that confirmed high grit scores for both groups. Questions 4 and 5 also elicited very few responses that reflected low grit.

Many of the responses that fell under the low grit theme described situations that created high stress and anxiety. Research has found that academic stress has a significant effect on retention (Wong & Chapman, 2024). In a review of 14 peer-reviewed studies, Lysnyj et al. (2023) found that there was a statistically significant relationship between perceived stress and academic achievement. Many of the responses that fall under the theme of low grit express feelings of stress and anxiety. In their systematic review of 29 studies that focused on the relationship between grit and academic performance and retention, Christopoulou et al. (2018) found that most studies verified a positive link between grit and academic performance and retention. Group 1 Grit-S scores were significantly higher than Group 2, and most of the answers to the semi-structured interview from Group 1 participants reflected higher grit through responses that were assigned the pattern code overcoming barriers and challenges. This was the most prominent pattern code for Group 1. Responses that demonstrate high grit include Mary Grady's answer in response to the second question in the semi-structured interview: How do you usually respond when you encounter obstacles or setbacks while working toward a goal? She simply answered, "I don't give up."

Theme Three: Growth Mindset

The first phase quantitative results of this mixed-methods study found no significant difference between the growth mindset scores of Group 1 and Group 2. However, it is worth noting that both groups scored in the mid-range of the growth mindset scale. Both Group 1 and Group 2

exhibited a growth mindset with some fixed ideas on both the intelligence and character subscales. Also, the pattern code intelligence can be improved which falls under the third theme of growth mindset was included in the top five most prominent codes in the packed code clouds generated by the qualitative coding software dedoose. Although the first quantitative phase of this mixed-methods study did not find a significant difference in growth mindset scores between Group 1 and Group 2, intelligence can be improved was the second most prominent pattern code for Group 1 and the fourth most prominent for Group 2. See Figures 13 and 14 for the packed code clouds and Tables 21 and 22 for lists of the most prominent codes in each group. The following analysis compares answers to the questions in the semi-structured interview that are focused on mindset.

The first mindset question asked: When you receive feedback or criticism, how do you typically respond? The pattern of answers to this question reveals a desire to learn from feedback and criticism but with the caveat that the feedback received is constructive. Some responses express ambivalence about criticism. For example, Andrew Boyer of Group 1 said, “I like to learn things from feedback. I want to make sure one, if I’m going to receive feedback from somebody, I want to make sure they are educated in what they are giving me feedback on.” Lester Doyle of Group 1 said, “I guess it depends on how the feedback or criticism is delivered. But if it seems like it’s genuine feedback criticism, and they’re trying to help me learn something, I’m usually open to receiving it.” Jasper Banks of Group 2 said, “Yeah, criticism is tough. So, I would try to reevaluate myself and try to see things from their perspective.” Harry ODonal of Group 2 responded: “Knowing that there is some good faith without having that negative aspect around it to say, hey, this is exactly what you did wrong, then I know I can learn from that.”

The second mindset question was: How do you view mistakes or failures in your learning process? Andrew Boyer of Group 1 answered: “I think they’re necessary. I don’t like them. I want to avoid them at all costs. But I do think they’re necessary.” Harry ODonal of Group 2 said,

> Failure is a very strong word for me, as I define failure as not learning from your mistakes. So, if I failed an exam, for example, I don’t really consider that failing. I make the best effort to learn from those. So, I do not fail.

Both Group 1 and Group 2 participants said that they try to learn from failure. The most common pattern code assigned to these answers was learned from failure which falls under the growth mindset theme. Answers from participants in both groups were similar lending support to the Phase 1 quantitative results that found no significant difference between groups in mindset scores.

Mindset question three was: Do you believe people can change their abilities and intelligence over time? Why or why not? Participants in both groups answered yes to this question. Again, this is consistent with the first quantitative phase results. For example, Mike Walton of Group 1 said,

> Anything is possible if you put work into it. Some people might learn faster. Some people might have it a little easier, but at the end of the day, if you put work into it, whether it’s longer or shorter than somebody else, you can grow your intelligence and be just as good as somebody else.

Matt Vanna of Group 2 said, “I believe people can absolutely change their abilities and how they respond to things, but not with time. It comes with experiences.”

Again, both groups answered this question in ways that demonstrated a belief that intelligence and abilities can be improved which is consistent with the quantitative findings in the first phase of this mixed-methods study. Although there was unanimous agreement that intelligence is not fixed, some responses added that people who are naturally talented or intelligent have an advantage and may learn faster than those who are not naturally talented. These statements reflect more of a fixed mindset which supports the quantitative results in Phase 1 of this study and will be discussed in the next section.

The fourth mindset question in the semi-structured interview asked: What do you think is more important: natural talent or the effort and time you put into developing a skill? Please explain your reasoning. All answers to this question expressed a belief that effort and time is more important than natural talent. For example, Lester Doyle of Group 1 answered that effort and time were more important in developing a skill or knowledge. He added, "But if you apply yourself to just about any area, I mean, you may not be the best at it, but you can excel in your own way." Mary Grady of Group 1 said, "I think effort and time is more important. Natural talent. If you don't work on it, it might not improve." Jasper Banks of Group 2 said, "Well, just like I said, I think effort and time. Everybody learns at a different pace and everyone has raw talent. But if somebody can put in their effort and time, they're going to see results."

These responses were assigned concept codes effort and time more important, talent not enough, intelligence not innate, always more to learn, and push beyond comfort zone which were all categorized under the pattern code intelligence can be improved. These responses reflect a growth mindset as described in the model of mindsets in Figure 2 (Dweck, 2016). A growth mindset results in higher levels of achievement through embracing challenges, persisting in the face of setbacks, seeing effort as the path to mastery, learning from criticism, and finding lessons

and inspiration in the success of others. Although there was no significant difference in growth mindset scores between Group 1 and Group 2, both groups scored in the middle range which reflected a mixture of growth mindset and fixed mindset beliefs. Responses to the questions in the semi-structured interview reflected a growth mindset with some fixed ideas. For example, when asked if he believed people can change their abilities and intelligence over time, Mike Walton of Group 1 said, "Anything is possible if you put work into it. Some people might learn faster. Some people might have it a little easier." This answer is consistent with a growth mindset with some fixed ideas. However, these mixed responses may also be due to a lack of process validity. Limeri et al. (2020a) defined process validity as "a common set of cognitive processes when responding to items. In other words, process validity would demonstrate that the term intelligence is defined consistently by participants in a survey. Limeri et al. (2020a) found that post-secondary students' definition of intelligence was inconsistent which may explain why there was no significant difference between the mindset scores of Group 1 and Group 2. The next section looks at answers to these questions that reflect a fixed mindset.

Theme Four: Fixed Mindset

The predominant pattern codes assigned to responses to the mindset questions in the semi-structured interview included intelligence can be improved, learned from failure, and positive view of criticism. These pattern codes were associated with the third theme of growth mindset. Pattern codes associated with the fourth theme of fixed mindset included intelligence is fixed and negative view of criticism. Concept codes included differences in talent, some people think better, difficulty with negative criticism, and ego problem. The number of these fixed mindset codes assigned to responses from both groups was low compared to the number of codes associated with the theme growth mindset.

Answers to the first question about how participants respond to feedback or criticism included the following.

- Andrew Boyer of Group 1 said, “Sometimes I do find it hard to swallow my pride.”
- Lester Doyle of Group 1 said, “If it’s more of a negative connotation, I’m usually not as open.”
- Mike Walton of Group 1 said, “When I first came in, I didn’t take it, feedback, very well because I had a pretty big ego.
- Jasper Banks of Group 2 said, “Criticism can be a hard pill to swallow. Criticism is tough. But yeah, some of the criticisms are tough to deal with.”
- Harry ODonal of Group 2 said, “A comment that is very extremely negative is very demoralizing.”

These answers were assigned concept codes that included difficulty with negative criticism and ego problem. However, it is important to note that responses oftentimes were mixed as noted under the third theme growth mindset.

The second mindset question was: How do you view mistakes or failures in your learning process? Answers that were assigned concept code difficulty dealing with failure and pattern code discouraged by failure included the following:

- Mary Grady of Group 1 said, “Sometimes failures and mistakes slow me down.
- Peter Carrier of Group 2 said, “I’ll be sulking and sleeping all day just trying to get over it.
- Matt Vanna of Group 1 said, “I do tend to beat myself up about mistakes.”

The third mindset question asked: Do you believe people can change their abilities and intelligence over time? Why or why not? Again, there were responses that reflected a fixed

mindset, but there were fewer than the responses that reflected a growth mindset. When comparing himself to his brother, Andrew Boyer of Group 1 said, “It always came easily for him. I’ve always said, it’s just because he’s smarter than me.” Peter Carrier of Group 2 answered, “This one’s kind of tricky. Yes, I don’t want to say no because there are some things that people are just naturally gifted at.” These responses were assigned the concept codes differences in talent and some people think better. The pattern code was intelligence is fixed. Again, there were a relatively small number of responses that were assigned the fixed mindset codes. Most were assigned to the third theme of growth mindset. This is consistent with the first phase quantitative results that found a growth mindset with some fixed beliefs for both groups.

The fourth mindset question in the semi-structured interview was: What do you think is more important: natural talent, or the effort and time you put into developing a skill? Please explain your reasoning. The following answers were assigned the concept code differences in talent and the pattern code intelligence is fixed.

- Mike Walton of Group 1 answered, “Natural talent comes with people, and you can be great.
- Matt Vanna of Group 2 said, “Natural talent does make it a lot easier to keep going.”

Although these responses reflected the fourth theme of fixed mindset, they were relatively few compared to responses under the third theme of growth mindset, and the responses were often mixed. This again supports the first phase quantitative results that placed both groups in the middle range of growth mindset with some fixed ideas. An example of a mixed response when asked if natural talent or effort and time are more important in developing a skill, Matt Vanna of Group 2 said, “Natural talent does make it a lot easier to keep going - But I think effort is more important than having natural talent.”

The last question was designed to capture any remaining thoughts about grit and growth mindset: Is there anything else you would like to share about how you respond to challenges and your attitudes toward learning and intelligence? The following responses best represent the closing thoughts of each group:

Lester Doyle of Group 1

> But looking back now, I feel like I've learned a lot and been able to look at mistakes and have takeaways from them. And I don't feel like any challenge is too large to overcome. I think persistence is the biggest thing with overcoming challenges.

Mary Grady of Group 1

> I know by the end of it, I'll become a better person for it.

Peter Carrier of Group 2

> I will never quit. I'll never back down. That's all you really need. And like, as well as intelligence, you know, just keep trying. Just don't give up. That's really what it is about. Even if you must learn a different way, it'll eventually come. Come around.

Harry ODonal of Group 2

> I believe that a positive mindset is the best way to approach any challenge. You always want to maintain a positive attitude.

The responses to this final question are consistent with all responses to the semi-structured interview. The predominant codes associated with these answers supported the themes of high grit and growth mindset. In addition to the four main themes that emerged from the qualitative data, two subthemes emerged under the theme of high grit: internally motivated and externally

motivated. See Appendix B for the concept codes assigned under the pattern codes internal motivator and external motivator. The next section will compare the responses of Group 1 and Group 2 that were assigned the pattern code internal motivator.

Subtheme: Internally Motivated

Two subthemes emerged from the qualitative data collected by the semi-structured interviews in Phase 2 of this mixed-methods study. Answers to the first five questions concerning grit revealed that some participants were more internally or self-motivated while others were more influenced by external or outside factors. This section reviews responses to the grit questions that were assigned the pattern code internal motivator.

The first grit question was: Can you tell me about a long-term goal you pursued? What challenges did you face and how did you stay motivated? The following answers to this question were assigned concept codes that fell under the pattern code of internal motivator. When describing what keeps him motivated in pursuit of his long-term goal, Andrew Boyer of Group 1 answered, "But additionally, it's something that I enjoy and I long for." Mary Grady of Group 1 said that she focuses on herself and what she is doing to stay motivated. Describing how he stayed motivated after failing his commercial pilot check ride, Peter Carrier of Group 2 said, "So, I'm glad I did retake it. I'm glad I passed it the second time. Even if it wasn't the first time, I still got it done. I still feel good about it." These responses revealed that these participants were self-motivated or internally motivated. Concept codes assigned to these responses included passion for aviation, focusing on self, and motivated by progress.

Answers to grit question 2 revealed the same pattern. When asked how he usually responds when he encounters obstacles or setbacks, Lester Doyle of Group 1 replied, "I'd say I'm usually

optimistic about things. I know there always seems to be some sort of solution." Mary Grady of Group 1 said, "I think that was like my main motivating part and to make myself proud. So, I worked hard to accomplish that." Harry ODonal of Group 2 answered, "I start brainstorming and get myself into that positive mindset." The concept codes assigned to these responses were optimistic in solving problems and focusing on self which both fall under the pattern code internal motivator.

This pattern was repeated in response to the remaining grit questions in the semi-structured interview. For example, in response to the question about what keeps him going when he feels like giving up, Lester Doyle of Group 1 said, "Pride to myself and those around me because I put so much into this." Peter Carrier of Group 2 relies on his inner faith. When asked how he maintains interest and focus on a project for an extended period, Harry ODonal of Group 2 said, "It's really waking up each morning and seeing what's ahead and seeing what's next. What do I need to review? What can I get better at?" Concept codes assigned to these responses included motivated by progress and optimistic in solving problems. Again, these responses demonstrate that these participants are internally motivated or self-motivated. They don't rely on motivators outside of themselves.

Subtheme: Externally Motivated

The second subtheme that emerged from the theme of high grit was externally motivated. Responses that reflected a reliance on external motivators such as family, friends, or colleagues were assigned concept codes including fear of letting people down, fear of being wrong, pushed by family or friends, and peer success or failure. The following responses are examples of responses that were assigned these concept codes and the pattern code of external motivator.

The first grit question was: Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated? The following responses were assigned the pattern code external motivator. Andrew Boyer of Group 1 said, “Seeing my peers that have gone on to accomplish the same goal that I have.” Jasper Banks of Group 2 answered that the backbone of what motivates him is his family.

Question two: How do you usually respond when you encounter obstacles or setbacks while working toward a goal? Andrew Boyer of Group 1 responded that he finds comfort in knowing that he is not the only one dealing with the same challenges. Peter Carrier said that he surrounds himself with people who care for him. These responses express a reliance on outside influence for motivation and were assigned the pattern code external motivator which falls under the subtheme of externally motivated. The following list of responses to the remaining grit questions were assigned the pattern code of external motivator.

- My wife’s been pushing me along and kind of rooting for me the whole time.
- My family. I don’t want to let them down.
- My friends, my family, my mom.
- Really other people believe in you.
- I sort of talk to others.
- I saw a lot of fellow students struggling with this.

An unexpected pattern that emerged from these responses was the difference between Group 1 and Group 2 in the prominence of these subthemes. Responses from Group 1 participants were more focused on self-motivation than responses from Group 2 participants. In other words, one major difference between the groups was how they were motivated to continue to work toward

long-term goals despite barriers and challenges. Group 2 participants relied more on friends, family, faculty, and staff to provide motivation than Group 1 participants who were more self-motivated.

Summary of Phase 1 Quantitative Results

The first quantitative phase of this mixed methods study was designed to answer the first two research questions:

1. Is there a difference in grit scores between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?
2. Is there a difference in growth mindset between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration?

In the first quantitative phase, participants completed the Grit-S and Growth Mindset instruments on Qualtrics. Both groups scored higher than the population mean on the Grit-S scale which was 3.4 for all age groups. The mean Grit-S score for Group 1 was 3.60513245 and for Group 2 was 3.408653846. Both groups scored above the population average for this age group. A two-sample t-test was conducted comparing the mean scores of Grit Group 1 and Grit Group 2. The p-value in the two-tail t-test was less than 0.05. Therefore, the null hypothesis was rejected, and the alternate hypothesis was accepted. There was a significant difference in grit scores between students who initially enrolled and stayed in the Aerospace Professional Pilot concentration and students who initially enrolled in the Aerospace Professional Pilot concentration and switched to another concentration. Another two-sample t-test was conducted comparing the mean scores of Growth Mindset Group 1 Intelligence Subscale and Growth Mindset Group 2 Intelligence

Subscale. A separate two-sample t-test was conducted on the mean scores of the Growth Mindset Group 1 Character Subscale and Growth Mindset Group 2 Character Subscale. The p-value in the two-tail t-test for both subscales was greater than 0.05. Therefore, the null hypothesis was not rejected. There was no statistically significant difference between the mean scores of Growth Mindset Group 1 and Growth Mindset Group 2. However, according to the interpretation of the subscale scores, the mean scores for both the intelligence subscale and the character subscale of growth mindset for both Group 1 and Group 2 were in the upper mid-range of the scale. In other words, the mean scores for both the intelligence subscale and the character subscale for both groups were interpreted to indicate a growth mindset with some fixed ideas.

Chronbach's Alpha was calculated for the Grit-S and Growth Mindset instruments to test their reliability. A Chronbach's Alpha score below 0.7 is considered to indicate poor internal consistency within test items or questions. The Chronbach's Alpha for the Grit-S instrument was 0.699433 or just below the 0.7 Alpha value considered acceptable. The Growth Mindset Intelligence Subscale Alpha was 0.823269 which was above the minimum 0.7 Alpha considered acceptable, but the Growth Mindset Character Subscale Alpha was only 0.626677 which was below the minimum considered acceptable. Although a Chronbach's Alpha between .6 and .8 indicates a moderate level of internal consistency, a Chronbach's Alpha was calculated for both subscales combined. The combined Chronbach's Alpha was 0.711875 which is above the minimum 0.7 Alpha considered acceptable. Due to the low Alpha calculated for the Growth Mindset Character Subscale, a search was conducted for prior research on the reliability of the eight-item scale. A review of growth mindset instruments revealed the existence of several different scales. One scale from a company that trains athletes on mental performance featured 20 items. Another scale which was the subject of research by Rammstedt et al. (2022) tested an

instrument with three items and another with just one item. The authors claimed that there have been very few studies on the quality of the eight-item scale, and the results have been mixed. When Rammstedt et al. (2022) tested the three-item scale and the one item scale, they found both to be valid for measuring growth mindset. Another study by Limeri et al. (2020a) found that the eight item mindset scale lacked process validity. The original scale was designed for elementary age students and was not validated for post-secondary students. Limeri et al. (2020a) found that older students defined the word intelligence inconsistently which may explain the low Chronback's Alpha for the character subscale. Due to the questionable reliability of the eight-item scale, future research should employ a scale that has been well-validated. Instructions for completing the growth mindset instrument should include a definition of intelligence.

To summarize the Phase 1 quantitative results of this explanatory sequential mixed methods study, there was a statistically significant difference between Group 1 and Group 2 Grit-S scores. According to the two-sample t-test, the mean Grit-S score for Group 1 was significantly higher than the mean Grit-S score for Group 2. Therefore, the answer to the first research question was yes. There was a difference in grit scores between students who enroll and persist in the Professional Pilot concentration and students who subsequently change to another concentration. Students who enrolled and stayed in the Professional Pilot concentration were significantly grittier than students who enrolled in the Professional Pilot concentration but subsequently switched to another Aerospace concentration. This result supports the theory that individuals who score high in grit, which is defined as passion and perseverance for long-term goals, are more likely to reach their long-term goals despite barriers and challenges (Duckworth, 2016). In addition to the Grit-S instrument, participants completed an instrument designed to measure the non-cognitive trait of growth mindset. According to the two-sample t-test performed on each subscale, the mean growth

mindset scores for both subscales was not significantly different for Group 1 and Group 2. Therefore, the answer to the second research question was no. There was no difference in growth mindset scores between students who enroll and persist in the MTSU Aerospace Professional Pilot concentration and students who subsequently change to another concentration. Students who enrolled and stayed in the MTSU Aerospace Professional Pilot concentration did not score significantly higher in growth mindset than students who enrolled in the Professional Pilot concentration but subsequently switched to another concentration. Although there was no significant difference in growth mindset between Group 1 and Group 2, the mean scores for both the intelligence subscale and the character subscale for both groups were interpreted to indicate a growth mindset with some fixed ideas. So, both groups scored in the upper middle range according to Table 27. Even though there was no difference in growth mindset between the two groups, they both scored above the midpoint on the growth mindset scale. The second qualitative phase of this study was designed to explain and clarify the quantitative results of the first phase.

Table 27

Total Mindset Subscale Scores and Interpretation

SCORE	MINDSET
4 to 6 Points	Strong fixed mindset
7 to 10 Points	Fixed mindset with some growth ideas
10 to 13 Points	Growth mindset with some fixed ideas
14 to 16 Points	Strong growth mindset

(Dweck, 2016)

Summary of Phase 2 Qualitative Results

Phase 2 of this mixed methods study was designed to answer the third research question: What are the differences between the personal and educational experiences of students who enroll and subsequently graduate in the Professional Pilot concentration and those who subsequently change to another Aerospace concentration? This research design is called an explanatory sequential mixed methods study. It is sequential because the first quantitative phase is completed before the second qualitative phase, and it is explanatory because the second qualitative phase of this study is designed to give explanation and clarification to the first quantitative phase.

According to Richards (2015), modeling is one way to describe ideas with pictures. Qualitative data can be messy and overwhelming. It is usually complex and difficult to quantify. A model or diagram is one method of communicating relationships between qualitative data in the form of a picture which can be more effective than the written word in expressing how qualitative data is interpreted. As the saying goes, a picture is worth a thousand words. Models are also good at simplifying complex qualitative data and filtering out the noise that distracts from the data that matters (Richards, 2015).

The packed code clouds in Figures 13 and 14 were described earlier in Chapter 5 to begin the discussion about the findings of the second qualitative phase of this exploratory sequential mixed methods study. These packed code clouds were generated by the qualitative research coding software package dedoose. This software package not only helped organize and manage the codes assigned to the transcript data, but it also helped with the analysis of this complex data by providing a picture of the central concepts and themes that emerged from the second qualitative phase of this study. The most prominent codes are represented by the larger fonts in the packed code clouds. Figure 13 represents the qualitative data collected from the participants in Group 1. This group is

composed of MTSU Aerospace students who initially enrolled in and expect to graduate from the Professional Pilot concentration. Figure 14 represents the qualitative data collected from Group 2 participants who originally enrolled in the MTSU Aerospace Professional Pilot concentration but switched to one of the other Aerospace concentrations. The five most prominent codes for each group are presented in Tables 22 and 23. The codes are presented in order of prominence with the most prominent code listed first. These codes are central to understanding the differences between the educational experiences of Group 1 and Group 2 and how these differences provide an explanation and clarification of the Phase 1 qualitative results.

There were three important findings that were revealed by the packed code clouds in Figures 13 and 14. These findings reveal similarities and differences that are subtle and sometimes hidden within the interview transcripts, but they nevertheless provide clarification and support for the first phase quantitative results of this mixed methods study. The differences revealed in the packed code clouds are related to how each group perseveres to completion of long-term goals and how each group stays motivated. The similarities relate to how each group views intelligence.

The first two differences are related to the theme of high grit. In Chapter 4, many of the answers to the semi-structured interview questions provided by participants from both groups revealed differences in how participants from each group persist to completion of long-term goals. The most prominent code listed for Group 1 in Table 23 was overcoming barriers and challenges. This was a pattern code that fell under the theme of high grit. The most prominent pattern code for Group 2 was success strategies which is also a pattern code that fell under the theme of high grit. Although the first phase quantitative results demonstrated a significant difference between Group 1 and Group 2 in Grit-S scores with the scores of Group 1 significantly higher than Group 2, both groups scored above the population means for their age group (see Table 22). The differences

revealed by the packed code clouds provide clues about why Group 1 scored significantly higher in grit than Group 2.

Angela Duckworth (2016) defined grit as perseverance and passion for long-term goals. In her book, *Grit, The Power of Passion and Perseverance,* she described the work of Stanford psychologist Catharine Cox on cataloging the characteristics of high achievers. Cox researched the biographical details of 301 individuals who were highly accomplished. They included scientists, artists, philosophers, writers, and political leaders. Her goal was to estimate the intelligence of each high achiever based on biographical details and compare how intelligent these individuals were to each other and the general population. An unexpected observation made by Cox, was that IQ mattered least in differentiating the most accomplished from the least accomplished in the group. Cox looked at 67 personality traits and found that there was relatively little difference between the high achievers she called super-eminent and those who were just eminent. She identified a group of traits that she named persistence of motive, and Duckworth listed four that she identified as definitions of passion and perseverance. Duckworth rephrased the first two as indications of passion:

- Degree to which he works with distant objects in view (as opposed to living from hand to mouth). Active preparation for later life. Working toward a definite goal.
- Tendency not to abandon tasks from mere changeability. Not seeking something fresh because of novelty. Not looking for change.

The next two were rephrased as indicators of perseverance:

- Degree of strength of will or perseverance. Quiet determination to stick to a course once decided upon.

- Tendency not to abandon tasks in the face of obstacles. Perseverance, tenacity, doggedness (Duckworth, 2016, p. 77).

The most prominent pattern code in the packed code cloud for Group 1 was overcoming barriers and challenges. The concept codes that fell under this pattern code included don't quit, effort and persistence, giving up is failure, patience and trust, and sticking to plan. These concept codes align nicely with the above-mentioned traits associated with super-eminent high achievers. The similarity of these traits to the most prominent pattern code in the packed code cloud for Group 1 could explain the differences in grit between the two groups. The most prominent pattern code in the packed code cloud for Group 2 was success strategies. Although this pattern code fell under the theme of high grit, the codes that were most assigned to Group 1 participants describe personality strengths that contribute to persistence in the face of barriers and challenges. The following are examples of comments that were assigned the pattern code overcoming barriers and challenges:

- I knew I had to get it done.
- Just do your best and show up.
- Just sticking to it.
- Persistence is the biggest thing with overcoming barriers.
- Train the mind and overcome difficulties.
- I know I can overcome it.
- I don't give up.
- I don't want to fail is what keeps me going.
- I had to put myself out there a lot.
- Giving up is just like accepting failure.

The most prominent pattern code assigned to the data for Group 2 was success strategies. The concept codes under this pattern code included be proactive, breaking down tasks, change concentration, and taking a break. The comments that were assigned these concept codes described actions taken to help achieve a goal. Some of the Group 2 participants described how they switched goals because of a barrier or challenge. Others described how they took a different route to continue pursuing their original goal because of a barrier or challenge that prevented them from completing the MTSU Professional Pilot concentration. Examples of comments that were assigned the pattern code success strategies include the following:

- I circumnavigated.
- I needed to take a break.
- Sometimes goals can change.
- Putting it into smaller steps and tackling the smaller challenges.
- Being able to break problems down into small pieces.
- I just try things differently. Try different experiences.
- Explore different ways of learning.

Group 1 answers to the semi-structured interview questions revealed that they possessed an inner quality that allowed them to pursue a long-term goal no matter what type of barrier or challenge confronted them. Qualities that come to mind include will power and determination. Although the predominant codes for both groups fell under the theme of high grit, Group 1 displayed more of what Catharine Cox called persistence of motive.

This leads to the second difference between Group 1 and Group 2 which is how they stay motivated in pursuit of long-term goals. Looking back at the packed code clouds in figures 13 and

14 along with Tables 22 and 23, the third most prominent pattern code for Group 2 was external motivator. The third most prominent pattern code for Group 1 was internal motivator. Both pattern codes fell under two subthemes that emerged under the theme of high grit. See Table 25 for a list of concept codes that fall under pattern codes external motivator and internal motivator. Concept codes that fell under the pattern code internal motivator included focusing on self, proud, passion for aviation, motivated by progress. Concept codes that were categorized under the pattern code external motivator included pushed by family and friends, peer advice, and fear of letting people down. This unexpected finding demonstrates a major difference in the way the two groups stay motivated in pursuit of their long-term goals. See table 28 for a comparison of data related to the predominant pattern code internal motivator for Group 1 and external motivator for Group 2. Group 1 was more self-motivated than Group 2. The major motivator for Group 2 was outside of themselves in the form of family, friends, faculty, and fellow students.

Table 28

Group 1 and Group 2 Subtheme Data Comparison

Group - 1 Internal Motivator	Group 2 - External Motivator
I fell in love with the process of getting better.	A backbone of mine was my family.
I'd say I'm usually optimistic about things.	I don't want to let them down.
Pride to myself and those around me.	I had a lot of friends who cared about me.
I realized I didn't like being that person anymore.	It's really having other people to help motivate me.
Focusing on what I am doing.	My mom, I know she'd be let down if I gave up.

This is consistent with the difference between the most prominent pattern codes previously described. Group 1 participants are more self-reliant than Group 2 participants. Group 1 participants find more of their motivation to persist in their pursuit of long-term goals from within themselves. Group 2 participants were more likely to look outside of themselves to friends, family, faculty, and fellow classmates for motivation. In addition, the concept code effort and persistence was a more prominent code in the packed code cloud for Group 1 and was one of the least prominent for Group 2. According to the qualitative research coding software dedoose, almost 80% of the data that was coded with the concept code effort and persistence came from Group 1 participants. These findings are consistent with the first phase quantitative results that found a significant difference in Grit-S scores between Group 1 and Group 2.

The third and final qualitative finding relates to how each group viewed intelligence. The first phase quantitative results did not find a significant difference between Group 1 and Group 2 in Growth Mindset instrument scores. The packed code clouds for each group found a difference in prominence for the pattern code intelligence can be improved which was the second most prominent pattern code for Group 1 and the fifth most prominent for Group 2. The participants from both groups believed that intelligence was not fixed and could be improved with effort, but some of the data indicated a belief that some people with natural talent had an advantage. Comments that were assigned the pattern codes intelligence can be improved and intelligence is fixed are compared in Table 29.

The result of the qualitative second phase of this mixed-methods study determined that both groups of students exhibited high grit and growth mindset. The difference between the groups was in how they were motivated to achieve their long-term goals. Table 30 is a summary of the

four themes and two subthemes along with sample concept codes, pattern codes, and the researcher's interpretation.

Table 29

Comments with Pattern Codes Intelligence can be Improved and Intelligence is Fixed

Intelligence can be Improved	Intelligence is Fixed
I think that you can definitely make a difference.	He's naturally good at it.
I think it's hard work that beats talent.	I do think some people are able to process information better.
Always more to learn.	I think that some people definitely have an advantage.
Be open to learn from the process.	There are some things that people are naturally gifted at.
It's always going to be the effort you put in.	Natural talent does make it a lot easier to keep going.
There's a sense that you can learn, you can change.	He's naturally good at it.

Implications for Practice

Due to the forecasted and much publicized shortage of qualified commercial pilots, collegiate aviation programs and flight schools have experienced a significant increase in demand. Many programs have experienced growing pains which has resulted in delays in training and a decrease in retention rates. Many collegiate aviation programs will award flight instruction labs based on GPA. However, GPA is not always a reliable predictor of flight training performance.

Students who struggle with flight training tie up valuable resources which contributes to delays in training for other students.

If grit is a reliable predictor of flight training success, flight training programs could require students to complete the Grit-S instrument and base the award of a flight training lab on both Grit-S scores and GPA. In addition, aviation programs could include training designed to increase grit in student pilots. If students who are high in grit are more likely to succeed and complete flight training, the Grit-S instrument may help eliminate delays and make training more efficient in the nations flight training programs.

One important lesson learned from this study is that motivation for students to achieve their long-term goals can be very different from one student to another. Some students are very self-motivated with an inner strength and resolve that helps them overcome barriers and challenges. Other students rely on sources of strength outside of themselves to get them through difficult times. As an educator, it has always been my goal to find out what motivates my students to help them succeed, but this is difficult to do in a classroom with 60 to 80 students.

Students who are self-motivated usually do not require encouragement from sources outside of themselves. In my experience, these students are the ones who always sit in the first few rows and diligently take notes and ask questions. I have also noticed that students who require help or encouragement are usually the ones sitting in the back rows of the classroom, and these students are oftentimes in need of motivation from friends and classmates. However, they also tend to be socially isolated in a place where they are no longer around the people who provided encouragement and motivation before they graduated from high school. These students should be provided with opportunities to become acquainted with their classmates and to develop friends who can be a source of motivation and encouragement. To encourage this, large lecture classes

should also include opportunities for group discussions, exercises, and projects. Students should also be encouraged to join different student organizations that can offer lifelong connections and friendships. First year students should be required to live on campus. In addition, housing first year students with classmates who are enrolled in the same degree program may also lead to increased retention for students who are externally motivated.

Attention to the development of grit and growth mindset should not be limited to college age students. Multiple studies have confirmed a positive relationship between grit and academic achievement in primary school students, secondary school students, and undergraduate college age students. Grit has been shown to positively affect academic achievement as well as professional achievement later in life (Duckworth, 2016). Studies have also confirmed a positive relationship between growth mindset and educational attainment in all age groups, but the results have been mixed (Yeager & Dweck, 2020). One study found that there may be a lack of process validity when using the eight-item mindset instrument with older students because it was developed in studies with primary school children. Limeri et al. (2020a) discovered that older students tended to define the word intelligence differently. However, a later longitudinal mixed methods study using the same eight-item instrument but analyzing the data with a separate model for growth and fixed mindsets found that students in a mid-level undergraduate chemistry course tended to slightly shift to a growth mindset depending on their experiences with academic struggle. Students who overcame barriers and challenges in the course shifted toward a greater growth mindset. Students who continued to struggle with the course shifted toward a greater fixed mindset (Limeri et al., 2020b). Although there was no difference in growth mindset between the two groups of Aerospace students in the present study, both groups demonstrated a growth mindset with some fixed beliefs. Duckworth, (2016) found that grit predicted success in sales, and adults who were higher

in grit were more likely to earn advanced degrees. If grit and growth mindset have a positive effect on both academic and professional achievement later in life, development of grit and growth mindset should begin in primary school. Children who are taught passion and perseverance for long-term goals and a belief that intelligence is not fixed should experience greater success both academically and professionally later in life.

Recommendations for Future Research

As mentioned in Chapter 1, there were several limitations and delimitations in this research study. Limitations include the number of students who volunteered to participate in this study. Also, the sample was limited to Aerospace students enrolled at Middle Tennessee State University. Contact information was not available for students who left the university or switched to another college within the university. Participants were limited to Middle Tennessee State University Aerospace students who initially enrolled and stayed in the Professional Pilot concentration or transferred to another MTSU Aerospace concentration. Future research should include students who switch to a discipline outside of Aerospace, transfer to a different institution or drop out of higher education altogether. In addition, future research should expand the sample to include collegiate aviation programs outside of Middle Tennessee State University.

To determine if grit and growth mindset scores can predict success in a professional pilot program, future longitudinal research should measure grit and growth mindset in new collegiate professional pilot students and track their progress to see if grit and growth mindset scores change over time and are related to success in a collegiate professional pilot program. If there is a significant relationship between grit and growth mindset scores and success in a professional pilot program, the Grit-S and Growth Mindset measurement instruments could be employed to select students who will be more likely to succeed and graduate.

Finally, future research on growth mindset and college persistence should employ a mindset instrument that has been validated for use with post-secondary students. Instructions on completing the mindset instrument should include a definition of the word intelligence to ensure process validity (Limeri et al., 2020a).

Conclusion

There were three research questions that formed the basis for this study. These questions were focused on how grit and growth mindset is related to success and persistence in a collegiate professional pilot program. Due to the increasing demand for commercial pilots (Boeing Reports, 2022), flight schools and collegiate aviation programs have experienced tremendous growth. This growth has also resulted in some growing pains for many programs that were equipped to handle a small number of students. As a result, increasing the efficiency of these programs has become an issue. Many collegiate aviation programs have limited resources, and students who struggle to complete these programs tie up precious resources and create backlogs in training. Therefore, finding reliable tools that can identify students who are likely to succeed may help relieve these backlogs and increase the number of students who successfully complete training. In addition, these tools could be used to develop training courses to help collegiate aviation students successfully complete their flight training.

This exploratory sequential mixed methods study determined that MTSU Aerospace students who enrolled and stayed in the Professional Pilot concentration scored significantly higher in grit than students who eventually switched to another Aerospace concentration. Grit is defined as passion and perseverance for long-term goals (Duckworth, 2016). Therefore, students who possess a high degree of grit should be more likely to persist and successfully complete a collegiate professional pilot program.

In addition, this study found no difference in growth mindset between these groups. Growth mindset is defined as the belief that intelligence is not fixed and can be improved with time and effort (Dweck, 2016). Students who possess a growth mindset as opposed to a fixed mindset believe that they can increase their intelligence over time with effort. As a result, they take on challenges, persevere in the face of barriers and setbacks, see effort as a path to success, learn from criticism and failure, and are inspired by the success of others. These individuals tend to successfully complete long-term projects compared to individuals with a fixed mindset (Dweck, 2016). Although there was no difference in growth mindset scores between the two groups, most of the responses to the questions in the semi-structured interview from both groups supported a growth mindset. The lack of a significant difference in growth mindset scores may be due to low process validity (Limeri, 2020a) which was reflected in a low Chronbach's Alpha for the growth mindset character subscale. Despite the lack of a statistically significant difference in growth mindset scores, both groups scored in the upper mid-range of scores which signify a growth mindset with some fixed ideas (Dweck, 2016). This was supported by the responses of both groups to the mindset questions in the semi-structured interview which were assigned codes that signify a growth mindset with relatively few responses assigned codes that reflect a fixed mindset.

An unexpected result of the qualitative second phase of this mixed methods study was a difference in how each group stayed motivated in pursuit of long-term goals. Students who enrolled and stayed in the Professional Pilot concentration were more self-motivated than students who enrolled in the Professional Pilot concentration and subsequently switched to one of the other Aerospace concentrations. Recent studies have shown that there is a positive relationship between grit and academic success (Reysen et al., 2019, Christopoulou et al., 2018) In her book, *Grit, The Power of Passion and Perseverance,* Duckworth (2016) described the work of Stanford

psychologist Catharine Cox on the characteristics of high achievers. Cox identified a group of traits that she named persistence of motive, and Duckworth identified two as indicators of perseverance (Duckworth, 2016, p. 77): The degree of strength of will or perseverance. Quiet determination to stick to a course once decided upon, and the tendency not to abandon tasks in the face of obstacles. Perseverance, tenacity, doggedness.

For Group 1, the most prominent pattern code in the packed code cloud was overcoming barriers and challenges, and the concept codes that fell under this pattern code included don't quit, effort and persistence, giving up is failure, patience and trust, and sticking to plan. These pattern codes and concept codes in the packed code cloud for Group 1 are very similar to the traits identified by Catharine Cox which could explain the differences in grit between the two groups. The most prominent pattern code in the packed code cloud for Group 2 was success strategies. Although this pattern code fell under the theme of high grit, the codes that were most assigned to Group 1 participants describe personality strengths that contribute to persistence in the face of barriers and challenges.

In conclusion, this explanatory sequential mixed methods study found that Group 1 Aerospace students who enrolled and persisted in a professional pilot program scored significantly higher in grit than Group 2 students who did not persist but switched to another Aerospace concentration. This result was supported by the results of the second qualitative phase of this mixed methods study. Answers to the semi-structured interview by students in Group 1 were more focused on overcoming barriers and challenges through effort and persistence when compared to the answers from students in Group 2. In addition, there was no difference in growth mindset scores between the two groups, but mindset scores for both groups demonstrated a belief in growth mindset with some beliefs in a fixed mindset. Although the scores on the growth mindset

instrument revealed some belief in a fixed mindset, both groups demonstrated a greater belief in a growth mindset through their responses to the semi-structured interview in the second qualitative phase of this study. An unexpected finding in the second qualitative phase of this study confirmed that the Aerospace students in Group 1 were more self-motivated than the Aerospace students in Group 2 who depended more on friends, family, and classmates for motivation to carry on in the face of barriers and challenges. Lester Doyle of Group 1 demonstrated this self-motivation best at the end of the semi-structured interview when he said: “I don’t feel like any challenge is too large to overcome. I think persistence is the biggest thing with overcoming challenges.”

Table 30

Summary Table for Themes and Subthemes

THEME/SUBTHEME	CONCEPT CODES	PATTERN CODES
High Grit	Don't quit, sticking to plan, giving up is accepting failure, be proactive, breaking down tasks	Overcoming barriers & challenges Success strategies
RESEARCHER'S INTERPRETATION: Responses assigned to these codes signified a tendency to finish a long-term goal once it was started despite barriers and challenges. High grit was demonstrated through strength of will and patience to see things through.		
Low Grit	Barrier to achieving goal, not coming easily, difficulty dealing with failure, failures slow me down	Defeated by barriers and challenges Discouraged by failure
RESEARCHER'S INTERPRETATION**:** Responses assigned to these codes demonstrated a lack of will or patience in the face of barriers and challenges. Low grit was demonstrated by frustration and resignation due to failure or lack of progress.		
Growth Mindset	Always more to learn, effort & time more important, learned from feedback, learned from mistakes	Positive view of criticism Learned from failure Intelligence can be improved
RESEARCHER'S INTERPRETATION**:** These codes were assigned to responses that expressed an openness to improving intelligence through effort, time, criticism, mistakes, and failures. These responses signified a belief that intelligence is not fixed.		
Fixed Mindset	Differences in talent, some people think better, difficulty with negative criticism, ego problem	Intelligence is fixed Negative view of criticism
RESEARCHER'S INTERPRETATION: These codes were assigned to responses that demonstrated a belief that intelligence and talent are fixed traits that cannot be improved with time and effort or a belief that some people are born with talent and intelligence.		
Internally Motivated	Focus on self, passion for aviation, proud, motivated by progress, optimism in solving problems	Internal motivator
RESEARCHER'S INTERPRETATION**:** Responses demonstrated that the student was self-motivated and did not depend on external sources of motivation such as family and friends. Some responses demonstrated an inner strength and resolve.		

THEME/SUBTHEME	CONCEPT CODES	PATTERN CODES
Externally Motivated	Pushed by family or friends, peer advice, peer success, fear of letting people down	External motivator
RESEARCHER'S INTERPRETATION**:** These codes were assigned to responses that reflected a dependency on external sources of motivation and reinforcement such as family, friends, faculty, or staff.		

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Appendix A

Short Grit Scale

Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest – there are no right or wrong answers!

1. New ideas and projects sometimes distract me from previous ones.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

2. Setbacks don't discourage me.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all
4. I am a hard worker.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

5. I often set a goal but later choose to pursue a different one.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

7. I finish whatever I begin.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

8. I am diligent.
    - ❑ Very much like me
    - ❑ Mostly like me
    - ❑ Somewhat like me
    - ❑ Not much like me
    - ❑ Not like me at all

Mindset Questionnaire Instructions

This survey has been designed to explore ideas about your intelligence (items 1-4) and character (items 5-8). Please indicate the extent to which you agree or disagree with each of the following statements:

1. Your intelligence is something very basic about you that you can't change very much.

Strongly disagree	Disagree	Agree	Strongly agree
4	3	2	1

2. You can learn new things, but you can't really change how intelligent you are.

Strongly disagree	Disagree	Agree	Strongly agree
4	3	2	1

3. No matter how much intelligence you have, you can always change it quite a bit.

Strongly disagree	Disagree	Agree	Strongly agree
1	2	3	4

4. You can always substantially change how intelligent you are.

Strongly disagree	Disagree	Agree	Strongly agree
1	2	3	4

5. You are a certain kind of person, and there is not much that can be done to really change

Strongly disagree	Disagree	Agree	Strongly agree
4	3	2	1

6. No matter what kind of person you are, you can always change substantially.

Strongly disagree	Disagree	Agree	Strongly agree
1	2	3	4

7. You can do things differently, but the important parts of who you are can't really be

Strongly disagree	Disagree	Agree	Strongly agree
4	3	2	1

8. You can always change basic things about the kind of person you are.

Strongly disagree	Disagree	Agree	Strongly agree
1	2	3	4

Demographic Questionnaire and Interview Request

1. What was your first declared Aerospace concentration at MTSU?

A. Pro Pilot
B. Aviation Management
C. Flight Dispatch
D. Maintenance Management
E. Unmanned Aircraft Systems
F. Unmanned Aircraft Systems Technology
G. Aerospace Technology
H. Other

2. In which MTSU Aerospace concentration do you intend to graduate?

A. Pro Pilot
B. Aviation Management
C. Flight Dispatch
D. Maintenance Management
E. Unmanned Aircraft Systems
F. Unmanned Aircraft Systems Technology
G. Aerospace Technology
H. Other

3. What class do you belong to?

A. Freshman
B. Sophomore
C. Junior
D. Senior

4. Would you be willing to participate in a follow-up interview?

A. Yes
B. No

5. If yes, please provide contact information:

Email: _____

The Effect of Grit and Mindset on Professional Pilot Student Persistence
Interview Protocol: Please relate these questions to your educational experience.

1. Can you tell me about a long-term goal you pursued? What challenges did you face, and how did you stay motivated?

2. How do you usually respond when you encounter obstacles or setbacks while working toward a goal?

3. What keeps you going when you feel like giving up on something important to you?

4. Can you describe a time when you worked on a project or skill for an extended period? How did you maintain your interest and focus?

5. How do you handle situations where success doesn't come quickly or easily?

6. When you receive feedback or criticism, how do you typically respond?

7. How do you view mistakes or failures in your learning process?

8. Do you believe people can change their abilities and intelligence over time? Why or why not?

9. What do you think is more important: natural talent, or the effort and time you put into developing a skill? Please explain your reasoning.

10. Is there anything else you would like to share about how you respond to challenges and your attitudes toward learning and intelligence?

Debriefing

Dear Study Participant:

Thank you for taking the time to share your experiences.

This study seeks to understand how success and persistence in a collegiate professional pilot program is influenced by the noncognitive traits known as grit and growth mindset. Grit is defined as passion and perseverance for long-term goals. Growth mindset is defined as the belief that intelligence is not fixed and can be improved with effort.

The purpose of this study is to determine if students who enroll and eventually graduate in a collegiate professional pilot program score higher in grit and growth mindset than students who enroll in a collegiate professional pilot program but graduate in another concentration. The results of this research will help formulate recommendations to increase collegiate professional pilot student retention which has been persistently low.

If you have any questions or concerns, please do not hesitate to contact me. My email address is Robert.Fowler@mtsu.edu, and my office phone number is (615) 898-5734.

For additional information about giving consent or your rights as a participant in this study, please contact the Middle Tennessee State University (MTSU) Office of Compliance at 615-494-8918 or via email at irb_information@mtsu.edu.

http://www.mtsu.edu/irb

Thank you again for your time.

Sincerely,
Robert Fowler
Assistant Professor
Aerospace Department
Middle Tennessee State University

Appendix B

Theme	High Grit	Commitment and passion for long-term goals
Pattern Code	Overcoming Barriers & Challenges	Barriers or challenges do not defeat
Concept Code	Ask for Help	Dealing with difficulties by asking for help
Concept Code	Giving up is accepting failure	Persistence will lead to success
Concept Code	Humor	Dealing with difficulties with humor
Concept Code	Overcame financial challenge	Students were not defeated by cost
Concept Code	Patience & Trust	Patience and trust in process
Concept Code	Research	Overcoming barriers and challenges by researching solutions
Concept Code	Sticking to plan	Persistence to achieve long'-'term goal
Concept Code	Train the Mind	Training the mind to overcome difficulties
Concept Code	Don't quit	Persistence to achieve goals in face of challenges
Concept Code	Effort & Persistence	Effort & persistence is most important for success
Pattern Code	Success Strategies	Developed strategies for success
Concept Code	Be Proactive	Getting tasks done ahead of schedule instead of procrastinating
Concept Code	Breaking Down Tasks	Breaking down a big project into smaller chunks
Concept Code	Change Concentration	Continued to pursue nonflying degree
Concept Code	Have Fun	You need to have some fun to get reinspired
Concept Code	Learned from Related Experience	Students tried to learn and apply knowledge from related experiences
Concept Code	Setting Goal	Setting short term goals
Concept Code	Setting High Goal	Setting an unrealistically high goal
Concept Code	Taking a Break	Took a break to re-evaluate goal
Concept Code	Tenacity	Explore different ways to learn
Concept Code	Understanding vs Memorizing	Trying to understand material rather than just memorizing
Concept Code	Visualization	Motivated by visualizing future life in aviation

Sub-Theme	Internally Motivated	Motivation comes from within
Pattern Code	Internal Motivator	Self-motivated
Concept Code	Focusing on self	Focused on self rather than competition
Concept Code	Long-Term Goal Professional Pilot	Student's long-term goal is pro pilot
Concept Code	Motivated by Faith	Religious faith helps motivate me to succeed
Concept Code	Motivated by Progress	Motivated by seeing progress being made
Concept Code	Optimism in solving problems	Does not let problems influence optimism
Concept Code	Other long-term goal	Student's long-term goal is not pro pilot
Concept Code	Passion for Aviation	Primary motivator is a passion and enjoyment for aviation
Concept Code	Past Regrets	Motivated by failures in the past
Concept Code	Proud	Pride is an internal motivator
Concept Code	Work for airline	Student's long-term goal is working for an airline

Sub-Theme	Externally Motivated	Motivation comes from outside influences
Pattern Code	External Motivator	Motivated by outside influence
Concept Code	Fear of Being Wrong	Afraid of making a mistake in front of peers
Concept Code	Fear of Letting People Down	Motivated by fear of letting down family or friends
Concept Code	Motivated by Negative Consequences	Fear of failure is motivating
Concept Code	Peer Advice	Talking to peers is motivating
Concept Code	Peer Failures	Comfort knowing that peers have struggled too.
Concept Code	Peer success	Motivated by success of peers
Concept Code	Potential Earnings	Motivated by the high earning potential of a professional pilot
Concept Code	Pushed by Family or Friends	Family or friends are major external motivator

Theme	**Low Grit**	**Demonstrates a lack of passion and perseverance**
Pattern Code	Defeated by Barriers & Challenges	Barriers and challenges tend to defeat
Concept Code	Barrier to Achieving Goal	Some problems or challenge prevented goal attainment
Concept Code	Burn Out	Pushed to the point of burn out
Concept Code	Doubt Ability to Learn	Students had doubts about the ability to learn all knowledge
Concept Code	Not Coming Easily	Discouraged by difficulties and delays
Pattern Code	Discouraged by failure	Failure leads to discouragement
Concept Code	Difficult Classes	Discouraged by difficult classes
Concept Code	Difficulty Dealing with Failure	Discouraged by failure
Concept Code	Failures Slow Me Down	There are times when failures or mistakes can slow down progress

Theme	**Growth Mindset**	**A belief that intelligence can be improved**
Pattern Code	Intelligence can be Improved	A belief that intelligence is not fixed.
Concept Code	Always More to Learn	Belief in continuous learning
Concept Code	Effort & Time More Important	Effort & time will lead to improved intelligence
Concept Code	Experience Improves Intelligence	Experience and not just time and effort leads to intelligence
Concept Code	Intelligence is not innate	You are not born intelligent
Concept Code	Push beyond comfort zone	Intelligence can be improved by pushing yourself outside of comfort zone
Concept Code	Talent Not Enough	Talent is not enough to succeed. It takes work.
Pattern Code	Learned from Failure	Failure is opportunity to learn
Concept Code	Learned from Mistakes	Learning from mistakes leads to success
Concept Code	Must Fail to Learn	Students feel that failure leads to better learning
Pattern Code	Positive View of Criticism	Tries to learn from criticism
Concept Code	Learned from Feedback	Feedback & criticism helped learning
Concept Code	Open to criticism	Students try to learn from criticism
Concept Code	Open to genuine criticism	Accepts criticism if genuine

Theme	Fixed Mindset	A belief that intelligence is fixed
Pattern Code	Intelligence is Fixed	Intelligence cannot be improved
Concept Code	Differences in Talent	Some people are more talented than others
Concept Code	Some People Think Better	Some people are just better able to process information

Pattern Code	Negative View of Criticism	Has difficulty accepting criticism
Concept Code	Difficulty with negative criticism	Students have difficulty accepting criticism delivered in negative fashion
Concept Code	Ego Problem	Big ego prevented learning from criticism