Peer Mentoring and Test Anxiety in Collegiate Aeronautics Students: An Integrative Review

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Abstract

An integrative review was conducted to lay the foundation for further research focusing on the use of peer mentoring as a tool to reduce the anxiety pilots and mechanics feel for their oral and practical exams to increase student safety and performance. Research on performance anxiety in competitive sports, music performance anxiety, and academic test anxiety showed how anxiety levels relate to athlete and student performance. Feedback surveys from peer mentoring programs identified increased self-efficacy, increased student retention, and a better understanding of the applicable examination as possible benefits of such mentoring programs. I determined the proposed research question was the wrong question to ask, as an anxiety reduction may not correlate to increased performance but increased self-efficacy and student retention aid in aeronautics school's purpose to train competent and safe pilots and mechanics.

Keywords: peer mentoring, test anxiety, collegiate aeronautics, flight training, aircraft maintenance

Peer Mentoring and Test Anxiety in Collegiate Aeronautics Students:

An Integrative Review

Aviation students learn in a unique environment among college students. They are regularly tasked with the operation of equipment potentially worth a half million dollars and may have to operate this equipment for extended periods with minimal to no direct assistance from others. This operation, known as the "solo cross country" is a requirement for the initial certification of a Private Pilot and is typically completed within the first year of flight training. Aviation Maintenance Technician students are tasked with analyzing and fixing problems on aircraft. Though safety is of the utmost importance in these environments, with many checks and balances provided in the operation of an aircraft for flight training and maintenance training, it does not eliminate the simple fact that aviation brings an inherent risk.

On October 18, 2021, a Piper PA-28-181 aircraft used for flight training, was found destroyed in a field in North Dakota (National Transportation Safety Board, 2022). Subsequent examination by the National Transportation Safety Board (NTSB) of this solo training flight found no mechanical discrepancies with the aircraft. The final NTSB report determined the probable cause to be pilot suicide. Human factors must be considered when looking at the collegiate environment. This is evidenced by the increased rate of college students seeking counseling (Jacobs et al., 2020).

The aviation industry is one characterized by measured, intentional progress working towards the goal of a safer and more efficient airspace system. Though aviators understand a perfect system may never be reached, constant progress remains critical to the operation of aircraft. An understanding of the human factor is necessary for a safety-critical industry such as

aviation, and it may be the most important step (Moriarty, 2015). It makes sense then that this focus on the human aspect starts in the training environment with how educators train future pilots and mechanics, the environment students are trained in, and the tools that are provided to ensure future success as students move into their roles as pilots and mechanics into whose hands, customers will entrust their lives. There is a common quote in aviation, attributed to British pilot Captain Lamplugh, that illustrates the importance of this task: "Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect" (Aiello, 2021, para. 3)

Purpose

The purpose of this study is to lay a foundation for continued research on peer mentoring and test anxiety in collegiate aeronautics students, both pilots, and mechanics. The origin of this goal is personal. I spent over six years conducting training toward my pilot and mechanic certificates, including during the COVID-19 pandemic. During this time, I experienced the stress of aviation and the college environment firsthand in addition to seeing many of my friends and peers go through the same stresses. The specifics of my question originated in a discussion with a friend of mine training at a different flight school, in which they stated their belief that the lack of community and mentoring environment at their current school played a role in the level of test anxiety they experienced, especially during the training delays and uncertainty of the COVID-19 pandemic. Through more discussions and probing, that conversation led to this research question:

RQ1 – What is the impact of peer mentoring programs on the anxiety that collegiate aeronautics students have associated with Federal Aviation Administration (FAA) practical and oral exams?

An additional research question was identified to provide a more general understanding of the aviation industry, specifically collegiate aviation.

RQ2 – What is the current understanding of anxiety in collegiate aviation?

Background

The environment that college students currently find themselves in is complex and often introduces several new characteristics that students must manage. In addition to academic challenges, the primary purpose of a student's time at a university, college students must manage a new social environment (Mohamad et al., 2021). This can often lead to homesickness. Finances also play a role and can include tuition, the cost of living, and applications for scholarships. The combination of these factors can lead to mental problems such as depression and anxiety, physical problems such as health decline, and suicide. This is evidenced by the increased number of students seeking counseling (Jacobs et al., 2020). Collegiate flight students face these same challenges with the aided stressors found in all of aviation, including the safety critical environment in which pilots and mechanics operate. For example, flight students are tasked with the responsibility of managing a complex and costly piece of machinery, at times with no instructor.

The response of the pilot community to mental health issues is also of concern. FAA statements indicate that 59% of airmen would refuse SSRI medication or currently refuse such

medication if it was prescribed (Durham & Bliss, 2019). Considering the symptoms of anxiety and depression and generally short-term and the chances of reoccurring are minimal after treatment, this statistic is especially concerning. For these reasons, understanding the mental health and anxiety of college aeronautics students is an important task for any flight or aircraft maintenance school.

Methodology

Study Design

This study was conducted as an Integrative Review utilizing a Conceptual Framework based on a methodology used in the field of nursing (Whittemore & Knafl, 2005). Literature was retrieved from multiple databases including EBSCO Quick Search, Education Database (ProQuest), ProQuest Central, and PsycARTICLES (APA PsycNet). Keywords included anxiety, test anxiety, and performance anxiety. The keywords student, college student, and university student were also used. Finally, peer mentoring, mentoring, and mindfulness training were also used as keywords. The medical section included seeking input from a current Federal Aviation Administration Aviation Medical Examiner (AME) to understand the guidance from the FAA as the regulatory body over the operations of the aviation industry. The audience of this study was identified to be the community of pilots and mechanics in addition to administrators of flight and maintenance schools. For this reason, the desire to was to start the literature search at a foundational level.

Themes

The initial themes included anxiety and peer mentoring. Flexibility was allowed as the literature review process opened additional questions and led to themes that were not initially expected, such as Music Performance Anxiety. The final identified themes included peer mentoring, anxiety, test anxiety, performance anxiety, and methods of addressing anxiety.

Inclusion Criteria

The initial inclusion of a study was based on the title and abstract. The purpose and methodology of identified studies were reviewed before determining inclusion in this study. Research conducted in the last 10 years was prioritized, but some older studies were included. An assessment matrix was used to evaluate each article and the quality of each was assessed using the Johns Hopkins Nursing Evidence-Based Practice Appendix C: Evidence Level and Quality Guide (Dang & Dearholt, 2017). Select entries from the themes of anxiety in aeronautics and peer mentoring are included in the Appendix.

Literature Search

Defining Anxiety and Test Anxiety

For this study and its audience, it was necessary to establish the fundamentals of anxiety and test anxiety to allow for further expansion of the topic through later research questions. Anxiety is not a single emotion, and instead, is an imprecise term for a category or pattern of emotions typically centered around fear, called the unifying emotion (Kowalski, 2000; see also Izard, 1991; Levinson et al., 1999). Fear is an emotion characterized by the presence of physical danger. It is also described as an intense emotion (Page, 1999) and is thought to be the most dreaded emotion (Izard, 1991). Anxiety though is a common response to life events (Levinson et

al., 1999). One characteristic of anxiety is that the reaction is greater than the danger being faced, meaning the individual has incorrectly assessed the danger of their future circumstances. Anxiety disorders contain three components (Beidel, 2000). The first is the cognitive component. The mind, and how humans think, is central to the concept of anxiety. The second component is the somatic component. This includes an individual's heart rate and breathing and characterizes a higher state of attention or vigilance. The final component is behavioral avoidance. Some people may attempt to retreat or escape from the anxiety-inducing situation.

Anxiety is categorized into two broad categories: state and trait anxiety (Kowalski, 2000; see also Levinson et al., 1999). This can also be described as short or long-term anxiety. State anxiety is based on the current circumstances of the individual, such as a student who is working on a substantial research paper. Trait anxiety is long-term anxiety not just from a single set of circumstances. Trait anxiety means an individual has a higher tendency to anxiety, not that they are chronically anxious.

Test anxiety is state anxiety that an individual feels in preparation for an assessment or evaluation and stems from fear of poor performance or consequences of failure (Hull et al., 2019). Some anxiety is to be expected and unavoidable, with the potential to benefit a student in the examination. The three components of anxiety also apply to test anxiety. The cognitive component includes the fear of failure. In this component, anxiety can impair the higher-order thinking that an evaluation may require such that a highly anxious student will do worse on exams requiring high cognitive involvement. The somatic component is the same as before, such as increased heart rate. Finally, the behavioral component can include procrastination or avoiding studying, which can have a cascading effect on the student and their test anxiety. Test grades may

reflect a student's ability to cope with anxiety as much as it evaluates the skills and knowledge of the student. One interesting note is that the student's perception of the exam may have an impact on the level of anxiety experienced. Additionally, a student's belief that they can impact the outcome of the exam, called self-efficacy, versus external forces that they cannot control, has been shown to correlate with greater achievement (Hull et al., 2019).

Test Anxiety and Performance

The connection between anxiety and performance must also be considered in this research. Test anxiety has a close relationship with achievement motivation. The idea of achievement requires something difficult, and motivation plays a significant role in that achievement (Halvari & Svebak, 1999). Achievement considers two motives: the drive to succeed and a fear of failure. One could view it as an individual both running away from something and towards something else. A student pilot preparing for a flight check ride, including an oral and practical examination, would be working against an unsatisfactory result, and the additional costs associated with it, while also working towards a satisfactory result and the certificate that would follow. In 1957, John Atkinson proposed the conditions that would provide for an increase in motivation: a moderate chance of success with a high risk of failure. It is noted that the risk of failure is based on the perception of the individual, not necessarily the actual, statistical odds. Atkinson's proposal has been validated through experiments (Halvari & Svebak, 1999).

The relationship between anxiety and performance has been studied in multiple recent works (Hull et al., 2019; Majali, 2020; Martorell et al., 2021). Some studies addressed anxiety and stress in students around evaluation and exams (Hull et al., 2019; Majali, 2020) while others

looked at anxiety in the context of athletic competitions (Martorell et al., 2021). Though the differences between a traditional academic environment and the factors at play in athletic competitions are not the same, the academic yet performative nature of the practical and oral exams for maintenance and flight students provide that work completed in both environments had a place in this research.

Competitive Anxiety

Martorell et al. (2021) sought to understand competitive anxiety in a competitive sailing team in Spain and whether anxiety was always harmful in a sports environment. They consider apprehension and tension to be the defining characteristics of competitive anxiety and noted that the individual's perception of the challenge can play a significant role in the level of anxiety experienced. A unique factor in this environment is that there is a significant physical demand in addition to the cognitive demand that one would expect from a performance or evaluation. More properly, there is a somatic and cognitive component to this anxiety. Previous works had found individual athletes to perceive higher levels of anxiety than team athletes and others found that the cognitive portion of the anxiety had more influence on the actual performance of an athlete compared to the somatic anxiety. Put simply, an athlete's perception of the challenge can have a notable impact on the result

This study presented the Sports Anxiety Scale (SAS-2) to sailors in Spain (Martorell et al., 2021). The results were used to split the athletes into a high- and low-performance group while the performance of the athletes was based on the club's internal evaluation system. The researchers did not find a relationship between anxiety and performance. In their discussion, they noted that some of the anxiety felt by the athletes could have been understood as excitement, and

thus the athletes were viewing it positively. They also noted that sailing may not produce a high enough level of anxiety for this method.

Anxiety and Evaluation

When looking at test anxiety and academic evaluation, both studies noted that a certain level of anxiety, sometimes termed positive anxiety, may be beneficial and even necessary (Hull et al., 2019; Majali, 2020). For example, a lack of situational anxiety also referred to as state anxiety, can lead to irresponsible behavior such as a lack of studying (Majali, 2020). Since a certain level of anxiety can produce motivation to study, it can help overcome low performance. A lack of motivation, however, cannot be overcome. A high level of anxiety, however, can inhibit the ability to learn. Hull et al. included that a student's level of self-efficacy may impact the level of anxiety felt for an exam and how accurate of a measure the exam is. If a student believes that an examination is a poor evaluation of their skills, they may experience a high level of anxiety from the belief that their efforts and study may have no impact on the outcome of the exam. Students who believe their work can impact the outcome of the exam have been found to have greater academic achievement. Test anxiety, self-efficacy, and academic performance are related and have an impact on each other.

The two studies used a multi-part survey evaluating self-reported levels of anxiety. Majali (2020) desired to determine the relationship between achievement, anxiety, and motivation, whereas Hull et al. (2019) focused on the types of assessment and the student's self-efficacy. When Majali compared high-performing and low-performing students, they found that the high-performing students were 15% more anxious. This contrasts with the typical notion that high anxiety is not desirable and leads to lower performance but lends support to the idea that the

relationship between performance and anxiety tends toward a bell curve with an optimal level of anxiety (Martorell et al., 2021). Below the peak, the lack of motivation can lead to a lack of studying (Hull et al., 2019). Too high levels of anxiety can prevent learning and reduce performance on examinations. The researchers noted that higher levels of trait anxiety correlated with lower motivation, but high and medium levels of state anxiety correlated with high results in academic performance unless the student had low motivation. This low motivation could not be overcome. They also noted that other studies have found a negative relationship between test anxiety and academic performance. Finally, external factors such as parents or professors played a lesser role than internal motivation.

The first major finding of the work completed by Hull et al. was this: the more complex the examination, the higher level of anxiety experienced by the student (2019). Multiple choice exams reported the lowest levels of anxiety compared to term papers and oral presentations with the highest. A second major finding was that students with higher self-efficacy were less anxious and expected higher grades. The researchers further discussed self-efficacy and ways to improve it, such as providing opportunities for students to overcome challenges, possibly while working together with other students. They noted the impact of a student's previous failures and successes in similar exams and the possible benefit of engaging with fellow students when unfamiliar with the exam type. Their work demonstrated that test anxiety is a complex and multi-faceted concept.

Current Methods to Address Test Anxiety

The potential negative impact of anxiety on student performance in evaluations means that addressing this test anxiety is an important topic to research. Additionally, because students tend to have higher levels of anxiety the more complicated the exam type (Hull et al., 2019), this

has a unique benefit in aviation with the practical and oral elements of both pilot and mechanic certification. One traditional approach to addressing anxiety, in general, is cognitive therapy (Manderino & Yonkman, 1985). This method seeks to address the negative thoughts that are causing anxiety, thoughts that are typically irrational or non-proportional since anxiety is based on an individual's appraisal of the situation, and typically an improper or unrealistic appraisal (Levinson et al., 1999; Manderino & Yonkman, 1985). Additionally, relaxation techniques can be utilized, or new skills can be developed to eliminate the threat presented.

Stress inoculation is another traditional technique that has been used for nursing clinicals (Comadena, 1999). Like the previous technique, this method is based on the cognitive aspect of anxiety: using an individual's appraisal of the situation based on the theory that their thoughts on an event impact how they feel. Stress inoculation uses a three-phase approach. First, students are asked to conduct a fantasy exercise, using their imaginations to simulate the clinical. In aviation, this is termed chair flying. The second phase provides the students with the resources needed to address the anxiety including coping strategies and deep breathing methods. Finally, students are exposed to anxiety-inducing situations, starting with the low-anxiety ones first. This method was found to be generally successful based on student feedback.

Addressing Aviation Anxiety

Multiple studies have looked at how pilots currently manage their stress and anxiety and at new methods pilots could use to manage their anxiety, including pilots in commercial airlines where flight evaluations are a continuous part of operations. A majority use some type of coping strategy though often the focus is on the individual and not the tools provided by the employer (Cahill et al., 2019). In addition to the high-stress nature of the occupation, the schedule requires

time away from friends and family and may make regular exercise difficult (DeHoff & Cusick, 2018). Reported coping strategies included exercise, sleep, and relaxation, a focus on diet (Cahill et al., 2019), and a focus on a stable home life and social support structures (Sloan & Cooper, 1986). Individual coping strategies alone may not be adequate, and the emphasis should be on multi-component strategies looking at both the social and technical aspects of mental health (Cahill et al., 2019). Finally, there has been a recent movement from some airlines and labor organizations to incorporate mental health into the training to better address the mental health of those in the aviation industry (DeHoff & Cusick, 2018).

Two studies were found researching the use of training sessions to reduce anxiety in pilots. One utilized Mindfulness-Based Mental Training in a Norwegian combat squadron (Meland et al., 2015), and another utilized Cognitive Adaption Training with pilot cadets in the Air Force (Fornette et al., 2012). Both studies reported significant positive results and one found that those benefits were reported by the pilots two years following the intervention (Meland et al., 2015). Those pilots in the same study reported that mindfulness training had benefits as they deployed during a NATO-led operation against Libya. Many of the pilots in these studies reported continued use of the tools provided during the training sessions. A common thread throughout the pilot reports of both studies was being equipped with the tools necessary to manage the stresses they are presented with when they fly. A contrasting note was that the strict schedule of combat pilots meant finding time for the intervention and implementing strategies learned could be difficult (Meland et al., 2015).

A final, related, study worth including in this section assessed evaluation techniques to identify students who might be predisposed to anxiety and poor performance to provide support

at an early stage instead of preventing students from entering the program (Sloan et al., 2010). The researchers proposed that the difference between Debilitating Test Anxiety and Facilitating Test Anxiety for a student is having a coping mechanism. They used multiple inputs and surveys, including SAT scores, knowledge test scores, and the individual's university admissions index in addition to evaluations administered by the researchers and determined that the student's SAT score in conjunction with the researcher-devised Anxiety Assessment Test could be used to predict students who might experience high debilitating but low facilitating test anxiety.

The Impact of Mentoring

The next research objective was to determine the current understanding of how peer mentoring programs impact students in an academic environment. The desired focus was the impact of test anxiety specifically in academic disciplines that utilize evaluations outside of the traditional, written types. Three studies were included in this portion of the research: one conducted a literature review on peer mentoring (Terrion, 2012) and two conducted qualitative studies looking at the impact of peer mentoring sessions (Knight et al., 2018; Peltz & Raymond, 2016).

Previous works have shown some indications that peer support is more important than faculty support (Peltz & Raymond, 2016). Students who persisted through a nursing program reported greater faculty support than those who did not. The literature review conducted by Terrion (2012) also provided a valuable understanding of the effects of peer mentoring. Peer mentoring requires qualified students who will generally provide guidance and support (Terrion, 2012). The focus of mentoring sessions can be task/career related or it can be a time for psychosocial support. A different assessment of the focus includes four domains:

psychosocial/emotional, goal setting and career paths, academic support, and the existence of a role model (Pelz & Raymond, 2016). Categorizations for peer mentoring include the duration of the relationship, formality of the relationship, and whether the mentoring is structured or more spontaneous. One limitation of peer mentoring is the limited experience of the mentor: peers generally cannot provide significant long-term focused advice but instead can meet the current needs of a student while they are in the academic environment (Terrion 2012). Another benefit of this type of mentoring is found in the social aspect. Studies have shown that more students withdraw because they believe they are not a good fit for the university than withdraw for academic reasons. Peer mentoring serves to address some of the loneliness that new students may feel and provides for integration into the social and academic structures of a university. When mentors and mentees are properly paired, shared experiences between them can provide comfort. Peer mentoring may not provide a direct benefit for academic performance but has been found to increase the likelihood of a student persisting in the program and can lead to more academic satisfaction. This combined benefit can be referred to as social capital: a resource that students can draw upon when they face difficult aspects in their academic journey. The research concluded that positive human relationships provided significant benefits for student success.

The academic environments looked at by the other studies included students preparing for an oral phonetics exam called the Viva Voce Exams (Knight et al., 2018) and non-traditional students in a nursing program (Peltz & Raymond, 2016). Some of the qualifications for a non-traditional student included men, older students, and those living off campus. These students do not persist as often as the traditional students (for nursing, defined by characteristics such as female, college age, and living on campus). Both academic environments include atypical

examination types while the nursing program encompasses similar hands-on, practical skills testing like that found in aviation. Both studies found students perceived significant benefits from peer mentoring (Knight et al., 2018; Peltz & Raymond, 2016). For the Viva Voce Exams, 53 out of 56 students reported they felt less anxious about the exam (Knight et al., 2018). Those who reported a higher level of anxiety before the mentoring session reported a greater reduction in anxiety levels. Students reported a feeling of reassurance and the provision of creative strategies to prepare for the exam. The three students who reported an increase in anxiety levels noted a better understanding of the work needed in preparation for the exam.

The study of the nursing program surveyed students retroactively about their time in the program (Peltz & Raymond, 2016). They found some variance based on the gender of the student and the status of part-time vs full-time. Male students met more frequently, and part-time students were more likely to meet with a mentor but met less often than their full-time counterparts. Additional students who had failed a course were more likely to meet with a mentor. Finally, men perceived more psychosocial and academic support than women did. The researchers also found some trends based on the four proposed domains of peer mentoring. They found a significant relationship showing that mentoring focused on psychosocial and emotional support correlated with a higher perceived ability to persist in the program. Finally, part-time students were more likely to seek out connections within their degree of study. The researchers emphasized the connection between the student's perceived ability to persist and the support and role model provided by the mentor to those who experienced academic failure.

Anxiety in Aviation

It is beneficial to present the current FAA guidance on mental health and associated disorders before presenting current literature on the same topic. I reached out to a local AME for guidance, but all information presented here is publicly available from the FAA. The standard disclaimer applies: I am not a medical professional, nor am I presenting medical advice. The FAA standard for medical examinations is the *Guide for Aviation Medical Examiners* (Federal Aviation Administration, 2022). This is the tool that an AME uses when determining if an applicant may be issued a medical certificate or if they must be directed to the FAA for additional processes. Regarding pilots using selective serotonin reuptake inhibitors (SSRIs) for certain depressive disorders, the applicant must show a continuous period of six months with a stable dose of medication and without significant side effects or an increase in symptoms. Only four SSRI medications are currently considered. This condition requires a Special Issuance and must be granted by the FAA, not the AME. The FAA now provides guidance on Situational Depression or Adjustment Disorder. This allows the AME to issue a flight medical for conditions such as minor depression when precipitated by an event that would cause the average person to become depressed, such as the passing of a loved one, when symptoms resolve within 6 months of the event. The Psychiatric Conditions Table of Medical Dispositions provides guidance on when to defer to the FAA and states that "depression requiring the use of antidepressant medications" requires an FAA decision (Federal Aviation Administration, 2022, p. 201).

The literature available on anxiety in collegiate aviation students is limited but growing. Most of the research found looked at commercial airline pilots, though one study found was specific to collegiate aviation. Anxiety and depression have been described as the "common cold of psychiatry" (Durham & Bliss, 2019, p. 80). Anxiety and depression have been linked to some

plane crashes/suicides on commercial aircraft (Jacobs et al., 2020). SSRIs are a probable cause or contributing factor in some accidents. One survey found that nearly 60% of airmen would refuse SSRI medication if they were prescribed one or that they currently refused medication (Durham & Bliss, 2019). This is caused by a fear of retaliation from legislators, employers, or the public. Some of the factors specific to pilots in depression and anxiety included being away from home for extended periods, the presence of, or lack of, a stable home life, issues with close relationships, and a potential lack of social support (Jacobs et al., 2020; Cooper & Sloan, 1985). Flying itself is complex and contains the potential for uncertain, unforeseen circumstances (Fornette et al., 2012) though the public expects pilots to have superior coping skills and are self-sufficient (Sloan & Cooper, 1986). The factors associated with a lack of performance included fatigue and performance checks (Cooper & Sloan, 1985). Those associated with mental health included a lack of autonomy at work, fatigue, and a lack of social support. Finally, job satisfaction was associated with career opportunities, the organizational climate, and some domestic stressors such as family health.

The study conducted specifically in collegiate aviation compared the stress and anxiety levels of flight students in a collegiate environment to those outside of a collegiate environment (Jacobs et al., 2020). The researchers noted the potential for the collegiate environment to introduce stressors into the life of student pilots. The potential causes of stress and anxiety included financial issues, worry about workload, personal problems, fear of losing a medical certificate, and fear of failing a stage check or flight test and the additional financial cost that would incur. Failures at this stage may even have an impact on hiring at an air carrier, commonly called a commercial airline. The stated importance of this area of study included the potential

impact of untreated mental issues on academic performance but also the potential for a reduction in flight abilities to lead to errors and accidents. They found no significant difference between collegiate and non-collegiate flight students, nor did they find a difference between upperclassmen and underclassmen. Of note is that both studies referenced the importance of social support (Jacobs et al., 2020; Cooper & Sloan, 1985).

Musical Performance Anxiety

Throughout the literature search process, I found an unexpected area of research that proved to be a valuable resource in understanding how further work on test anxiety in collegiate aviation could be performed: Musical Performance Anxiety (MPA), or stage fright. Significant research has been accomplished in this area by researchers internationally. MPA is one of the most reported disorders when surveying musicians (Fernholz et al., 2019; Mumm et al., 2020). Definitions of MPA varied, but most described it as a performance subtype of social anxiety disorder with a focus on the individual, especially solo performances (Mumm et al, 2020; Burin et al., 2019; Fernholz et al., 2019), with an understanding that there may be a beneficial, or adaptive, aspect to MPA instead of the purely negative response to this type of anxiety (Paliaukienea et al., 2018).

The focus of the studies included a desire to understand the source of MPA (Burin et al., 2019; Paliaukiene et al., 2018; Ryan & Andrews, 2009), the student's responses to MPA (Mumm et al., 2020; Fernholz et al., 2019; Kokotsaki & Davidson, 2003). Additionally, one study looked at how the idea of flow impacted performance anxiety (Fullagar et al., 2013). The sources of MPA included the requirement of a solo performance compared to group performance and a lack of skill level (Ryan & Andres, 2009; Fullagar et al., 2013). There was disagreement as to whether

the gender of the student played a role in the level of MPA experienced (Fernholz et al., 2019; Kokotsaki & Davidson, 2003). One study found that high MPA was related to poor self-efficacy and lower academic achievement as determined by student grades (Paliaukiene et al., 2018). The responses found to MPA were consistent with those reported for anxiety in general, including physiological, such as increased heart rate, cognitive, such as fear, behavioral changes even to the point of avoiding the performance, and emotional responses, also including fear (Mumm et al., 2020).

The treatment options found in response to MPA were consistent throughout the studies. The two most mentioned were Cognitive Behavioral Therapy (CBT), and beta blockers (Mum et al, 2020, Fernholz et al., 2019). The highly specialized individual skill required by musicians and the performative way in which these skills are assessed is like the skills and assessments found in aviation and this research on MPA may provide a jumping-off point for further research.

Analysis

To best answer RQ1, the individual themes must be related first. Anxiety is a complicated group of emotions centered around fear, and for test anxiety, that fear can include the fear of failure, fear of the opinion of others, and the fear of the consequences of failure (Beidel, 2000; Hull et al., 2019; Kowalski, 2000; see also Izard, 1991; Levinson et al., 1999). Anxiety consists of three components and two general types, with most of the research presented focusing on the cognitive component of state anxiety. Test anxiety falls into the category of state anxiety, though applying the principle of Musical Performance Anxiety, it could also be considered social anxiety, depending on what specific fear is leading to the anxiety.

Looking at performance anxiety specifically, the level of anxiety a student, performer, or athlete feels does not appear to have a linear impact on the performance of the individual, and instead, multiple factors come into play (Hull et al., 2019; Majali, 2020; Martorell et al., 2021). A student with a lack of state anxiety may not study so an increase in anxiety for that student could be beneficial, but anxiety cannot overcome a lack of motivation if the student simply does not want to study. Self-efficacy also plays a role related to the student's belief of how accurate the exam is as an evaluation of student skill. The terms Debilitating and Facilitating anxiety provide a helpful guide to this question: the desire is for students to have a level and type of anxiety that encourages them to study, but does not inhibit learning (Sloan et al., 2010).

Multiple techniques have been used with the desire to influence the level the test anxiety students feel. Stress inoculation was found to be generally successful based on some student feedback (Comadena, 1999). Airline pilots face continuous evaluation in their careers, and one survey found that social support was the most significant predicting factor in anxiety (Sloan & Cooper, 1986). More recent studies conducted with military pilots desired to address the cognitive aspect of anxiety (Meland et al., 2015; Fornette et al., 2012). Both studies reported significant, though subjective and self-reported, positive results, even after live combat. Finally, an Anxiety Assessment Test was evaluated to identify the student who may be predisposed to test anxiety in aviation (Sloan et al., 2010).

Like before, mentoring and test anxiety do not have a simple, linear, relationship. Some students felt reassured and better prepared for their examination after peer mentoring, while others gained a better understanding of the test before them, leading to more anxiety (Knight et al., 2018; Peltz & Raymond, 2016; Terrion, 2012). The results appeared to be consistent with the

benefits of peer mentoring compared to faculty mentoring. Hearing from their peers allowed students to be better prepared for a test, and may lead to the student being more confident in their ability to persist through their program.

Focusing on RQ2, the presence of medical certificates for pilots tends to make conversations around anxiety and mental health difficult in aviation (Jacobs et al., 2020). The FAA has recognized this and has updated much of its medical guidance to consider the generally short-term effects of anxiety and depression (Federal Aviation Administration, 2022, Durham & Bliss, 2019). Some research has been conducted on airline pilots, but anxiety in the flight training environment remains an area in need of further research. In some aviation-focused studies, the importance of social support was noted (Jacobs et al., 2020; Cooper & Sloan, 1985).

The unexpected research on Musical Performance Anxiety provided further evidence that the cognitive approach may have some application in performative evaluation (Mum et al, 2020, Fernholz et al., 2019) but the use of beta-blockers is unlikely to be a valid approach for aviation because of the potential for added complexity in retrieving a medical.

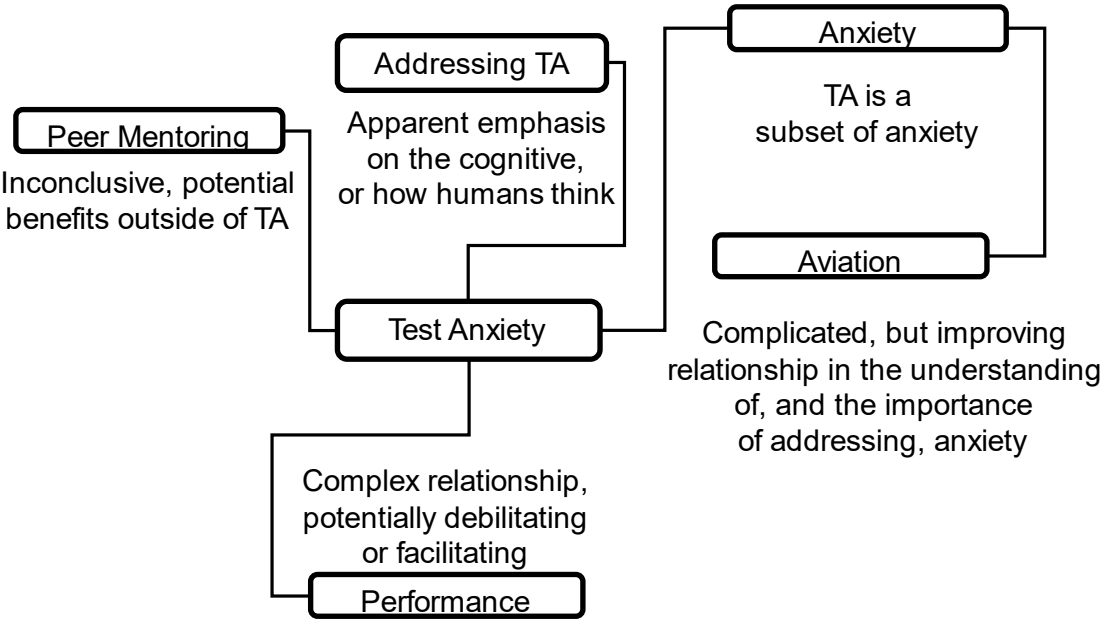
Conclusion

The final task is to address RQ1. Multiple areas have been researched in the desire to answer this question and Figure 1 proposes a potential map of these topics and how they relate. Based on these relationships and the information presented in this review, the answer to RQ1 is simple: it is the wrong question to ask. The goal of any aeronautics program is to produce competent, confident pilots and mechanics who can satisfactorily complete the required FAA tests and operate in a safety-critical environment. This research showed that an anxiety reduction may not be desirable in this outcome, and instead, it may be more important to provide students

with the resources to control and direct the anxiety all students feel before an evaluation. Peer mentoring has a positive impact on that desired outcome, helping students persist in the program. This may be especially important in-flight training, where even the weather itself can be a source of stress for flight students but engaging with peers who have been through the training and testing process shows current students that it can, and has, been done.

Figure 1

Test Anxiety Mind Map



Considering the environment in which aeronautics students are expected to operate, anxiety, test anxiety, and performance will continue to be important areas of research. Peer mentoring serves as a potential resource to address or improve the test anxiety a pilot or mechanic feels before a practical or oral examination, allowing the student to better prepare for

the evaluation that is required of them. Continued research is necessary on this topic, potentially focusing on peer mentoring programs in collegiate aeronautics schools and how such programs impact the successful completion of FAA exams.

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Appendix

Assessment Matrix including John Hopkins Evidence Level and Quality Guide

Article	Purpose	Sample	Methods	Major Findings	Grade
Mindfulness-Based Mental Training in a High-Performance Combat Aviation Population: A One-Year Intervention Study and Two-Year Follow-Up	Test the feasibility and value of mindfulness training in a Norwegian military combat squadron	n=21	Pilot completed questionnaires pre and post intervention were compared, plus a follow up check	1. Significant number of pilots reported benefits, even 1-2 years post intervention 2. Benefits were reported during a NATO-operation that was not initially part of the study	2.B
Cognitive-Adaptation Training for Improving Performance and Stress Management of Air Force Pilots	Investigate the "effects of cognitive-adaptation training on flight performance and stress management in a sample of pilot cadets who were undergoing a basic flying program"	n=21	Cadets were assigned to a control and training group, pre and post assessments were used to assess performance, stress management, anxiety, and mood	1. 70% of cadets reported the training allowed them to better grasp events and to reduce stress 2. Main reports were in the techniques learned	1.B
Stress Coping Strategies in Commercial Airline Pilots	"Investigate the nature and the importance of coping in commercial aircraft pilots"	n=442	Various surveys/instruments were solicited to pilots of the British Airline Pilot Association	1. Multiple coping strategies were identified 2. Social Support was the most significant predicting factor in anxiety	3.A

Article	Purpose	Sample	Methods	Major Findings	Grade
Depression, Anxiety, and Stress in Collegiate Aviators	"Determine if students who are enrolled in a collegiate flight program exhibit significant higher rates of depression, stress, and anxiety [compared to non-professional flight students]"	n=224	Mixed method research, utilized DASS-21 survey	1. No significant results, students enrolled in a collegiate program seemed to be just as prone to depression, anxiety, and stress	3.B
Occupational and Psychosocial Stress Among Commercial Aviation Pilots	Assess the sources of stress among commercial airline pilots	n=442	Surveys used to assess job satisfaction, mental health, pilot performance, sources of stress, life events, coping, and pilot demographics	1. "Overall mental ill-health was found to be associated with lack of autonomy at work, fatigue, and flying patterns, together with an inability to relax and a lack of social support"	3.A
Pilot Work Related Stress (WRS), Effects on Wellbeing and Mental Health, and Coping Methods	"Investigate the relationship between sources of work-related stress (WRS) for pilots, effects on wellbeing, and coping mechanisms"	n=1059	Anonymous Online Survey, included the Patient Health Questionaire-9 and Oldenburg Burnout Instrument; Analysis included an Ordered Logistic Regression Model	1. Over half met threshold for mild depression 2. Nearly 60% used coping mechanism for WRS including sleep management, exercise, and diet management	3.A
Effects of Associate Degree Nursing Students' Characteristics on Perceptions and Experiences of Mentoring	"Investigate how associate degree nursing program students experience mentoring and persistence"	n=283	Cross sectional study conducted via online survey using the College Student Mentoring Scale with nursing students throughout the state of Michigan	1. "The study found that men met with a mentor more frequently and perceived greater psychological, emotional, and academic support than women."	3.A

Article	Purpose	Sample	Methods	Major Findings	Grade
Viva survivors – the effect of peer-mentoring on pre-viva anxiety in early-years students	Understand peer mentoring as a tool to reduce anxiety for a phonetics viva exam	n=63	Anonymous, student completed questionnaires were used for assessment. The peer mentoring component was a single session two months before the exam	1. Significant reduction in anxiety (56/63 reported feeling less anxious)	2.B