

INDIVIDUAL DIFFERENCES AND STRESS REACTIONS AS PREDICTORS OF
PERFORMANCE IN PILOT TRAINEES

by

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Abstract

Firmly rooted in positive psychology, this study attempted to look beyond discovering the direction or shape of the stress-performance relationship and sought to instead determine the role of personality in this relationship. Although we were unable to test for moderation effects due to multicollinearity issues, we did discover that positive personality characteristics were a significant predictor of performance—even after controlling for experience and self-perceived stress. Interestingly, this relationship occurred in an opposite direction than expected in that higher levels of positive personality characteristics were predictive of lower performance ratings.

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Dedication

For my mom, Tonya L. Malone, and my papa, Johnnie W. Malone, Jr.: attempting to put my feelings into words is futile, so I'll just say this: I love you. Thank you for everything.

INTRODUCTION

In order to remain viable in an increasingly hypercompetitive global market, by necessity businesses and corporations are compelled to improve their organizational models and practices. These elevated practices require higher-caliber employees who are capable of handling perpetually escalating demands as well as possessing the ability to bear the burden of increased work-related stresses that are often associated with these demands. Stress is a topic that is receiving an ever-increasing amount of attention in the media and popular culture, blazing a path for so-called self-help “gurus” to attempt to capitalize upon this growing phenomenon by penning countless books on the subject while reality TV executives continue to place people in demanding situations to determine who will win the grand prize, be it a recording contract, money, or a prestigious position working for a multibillion-dollar corporation (e.g. *American Idol*, *The Amazing Race*, and *The Apprentice*, respectively). Meanwhile, sources such as these oftentimes neglect what has been unearthed through various scholarly research studies. Popular culture and self-help texts tend to conceptualize stress as a one-dimensional entity that individuals should either seek to avoid at all costs or attempt to manage via an assortment of relaxation techniques such as massage, meditation, and aromatherapy. However, Hans Selye (1975) discusses the dualistic nature of stress, suggesting that what is high stress in one individual and causes a decrement in performance can actually be perceived and utilized as a source of motivation for another. For instance, the basic training process that all branches of the United States military requires of those joining their ranks purposefully incorporates stressful activities into their training regiments in order to prepare recruits to respond appropriately while under duress.

The reason for this method is obvious in that the military seeks to minimize the negative impact that stress can have on soldiers' performance in real-world high stress situations. Due to the intense nature of this training, each year a percentage of recruits fail to successfully complete the program. Likewise, the Reserve Officer Training Corps (ROTC) for each of these branches also has attrition rates, where cadets unable to effectively cope with the pressures of the training environment opt to activate a self-initiated elimination during the ROTC's version of basic training. On the contrary, there are those individuals who experience a great deal of personal growth, emerging from training feeling more confident, capable, and mentally tough than before training commenced. This is a trend that occurs across many professions where performing under duress is critical (e.g., fireman, police officers, emergency medical technicians, pilots, paratroopers).

Although the effect of stress on performance has been debated for some time (Jamal, 2007; Muse, Harris, & Field, 2003; Westman & Eden, 1996; Jamal, 1984), researchers have suggested the debilitating effect that it can have on performance, citing the delicate balance between stress and performance that is needed for optimal functioning; for example the Yerkes/Dodson law (1908) states that a curvilinear relationship exists between stress and performance with a moderate level of stress resulting in optimal performance levels. This study sought to not only determine the ways in which stress and experience influence individuals' behavioral and psychological reactions, but attempted to determine whether specific personality characteristics, given similar stress levels, would be correlated with lower physiological responses (i.e. lower heart rate and blood pressure) and higher performance scores. Rather than take the traditional stance of examining the stress-performance relationship and highlighting the corrosive nature of stress, this study adopted a position that is becoming increasingly popular in

the field and chose to view this interrelation through the lens of positive psychology. To this end, a review of the available literature on the links between stress, performance, physiology, and personality was conducted. The following section contains an overview of the positive psychology movement followed by a review of the literature relevant to the link that has been shown to exist between stress and performance. Lastly, an examination of the research on the relationship between personality and stress will be followed by an exploration of studies pertaining to the connection between personality and performance.

Positive Psychology

Positive psychology advocates a shift from focusing on the pathological aspects of human cognitive processes and behaviors (e.g. a clinical perspective) to concentrating on the capacity for positive individual growth and development (Seligman & Csikszentmihalyi, 2000; Fredrickson, 2001; Luthans, Youssef, & Avolio, 2007). Some professionals in psychology doubt the endurance of this movement, referring to it as “faddish” and calling into question its focus on purely positive emotions (Lazarus, 2003; Christopher, Richardson, & Slife, 2008). Further, other authors have cited the illogical nature of attempting to separate the positive from the negative (Lazarus, 2003; Becker & Marecek, 2008). However, the proponents of positive psychology (e.g., Fredrickson, 2001; Seligman & Csikszentmihalyi, 2000) are adamant that this movement can improve the quality of life in both the personal and professional arenas.

Many of the concepts that make up this movement have been acknowledged for decades (Lazarus, 2003; Nelson & Simmons, 2005; Selye, 1975; Bandura, 1997; Maslow, 1971; James, 1994). The actual movement or, according to Lazarus (2003) and Becker and Marecek (2008) the “rebirth” of positive psychology, was prompted by Seligman and Csikszentmihalyi (2000). In an introduction on the topic, the authors delineate the goal of positive psychology as “begin[ing] to

catalyze a change in the focus of psychology from preoccupation only with repairing the worst things in life to also building positive qualities” (p. 5). The authors continue to highlight the importance of “valued subjective experiences,” “positive individual traits,” and “civic virtues” (p.5). As to Lazarus’ (2003) suggestion that positive psychology is the complete exclusion of “negative” psychology, the authors agree with supporters of this movement (Seligman & Csikszentmihalyi, 2000; Fredrickson, 2001; Christopher et al., 2008; Duckworth, Steen, & Seligman, 2005; Horsburgh et al., 2009; Golby & Sheard, 2004) and suggest that positive psychology actually recognizes *both* facets of human behavior, only it seeks to use the positive aspects to temper the damage that is generally associated with human pathology. In other words, rather than focus on the negative aspects of human behavior as is typically done in some areas of conventional psychology, positive psychology seeks to unearth the individual characteristics and/or traits that could serve as a buffer against the harmful effects of the negative side of behavior. Viewed in this light, even stress—having long been vilified as an unfortunate occupational and life hazard—can, under the right circumstances and with the right type of individual, benefit performance. One such characteristic that may serve to buffer the negative effects of stress on performance is Psychological Capital.

Luthans, Youssef, and Avolio (2007) defined psychological capital (PsyCap) as:

“...an individual’s positive psychological state of development [that] is characterized by (1) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (2) making a positive attribution (optimism) about succeeding now and in the future; (3) persevering toward goals and, when necessary, redirecting paths to goals (hope) in order to succeed; and (4)

when beset by problems and adversity, sustaining and bouncing back and even beyond (resiliency) to attain success” (p. 3)

According to Luthans et al. (2007), self-efficacy refers to those who self-select into difficult careers/jobs/tasks, embrace challenges, and are internally motivated. It should be noted that, contrary to Bandura (1997), Luthans et al. (2007) tend to view self-efficacy as being interchangeable with confidence. However, their conceptualization of this factor is rooted in the work of Bandura (1997) and is similar in that both definitions reflect an individual’s personal perceptions concerning their cognitive and self-motivational abilities as well as the individual’s probability of successfully completing a specific task regardless of the context. Optimistic individuals are those who have a strong internal locus of control and believe that positive life events are the result of their own actions and/or behaviors. Hopeful people establish challenging yet realistic goals and persist in their efforts to achieve those goals. If unsuccessful, pre-set contingency plans specifically designed for allowing them to continue uninterrupted along the path to success are put into effect. Finally, resiliency references individuals’ ability to rebound from failures and perform above and beyond pre-incident levels. The authors mention that this recoverability is not restricted to failures; rather that an individual’s response to success is equally important (2007).

Unlike the traits that are involved with personality theories such as the Five Factor Model (Goldberg, 1990; Costa & McCrae, 1992), the four PsyCap factors differ in that they are state-like, meaning that they are malleable and may be influenced by the environment. Therefore, rather than being permanent and fixed (e.g. trait-like), the PsyCap factors are more open to development (Luthans, et al., 2007). Given the positive nature of the PsyCap factors, it follows that the relationship between each PsyCap component and stress will be inverted. That is, as

PsyCap levels increase, the adverse effects on performance generally associated with stress will decrease, as will the associated physiological indicators (to be discussed in the “Stress and Performance” section).

In sum, although positive psychology has its fair share of cynics (Becker & Marecek, 2008; Christopher et al., 2008; Lazarus, 2003; Gable & Haidt, 2005), there is also a growing population of psychologists in support of this movement and its focus on fortifying human strengths as opposed to examining psychological weakness (Seligman & Csikszentmihalyi, 2000; Nelson & Simmons, 2005; McGowan, Gardner, & Fletcher, 2006; Fredrickson, 2001; Golby & Sheard, 2004). In relation to stress (herein defined as an event that occurs as a consequence of the person-environment relationship with measurable outcomes), it is suggested that certain positive personality characteristics can serve to buffer negative experiences (i.e. performance decrements). The four-pronged state-like personality construct, Psychological Capital, is hypothesized as one such characteristic.

Pilots must often demonstrate their ability to successfully perform a variety of skills in a flight simulator prior to taking control of an actual aircraft. The current study was unique in that performance was able to be measured via the use of a flight simulator, thereby creating a realistic environment that would be familiar to pilots. With performance being assessed in this way, the researchers hypothesized the following:

Hypothesis 1: PsyCap will be significantly and positively related to performance.

The Stress-Performance Relationship

Considering the subjective aspect of stress, the fact that a cohesive definition has yet to be reached is not surprising. A PsycINFO search of “stress” returned over 26,000 peer-reviewed journal articles for the five-year period between 2004 and 2009 alone. While there have been

many attempts to operationalize stress, four approaches have generally emerged: physiological indicators (i.e. increased heart rate, sweating, blood hormone levels, brain activity), psychological impediments (i.e. the inability to readjust post-trauma), workplace models (e.g. Demand-Control Model, Attentional Model), and subjective assessments (i.e. ranking feelings of stress via a Likert-type scale). Nevertheless, a definition that incorporates all of the abovementioned indicators and finds general agreement among psychologists has not fully emerged. In a review of the stress literature and in an attempt to rectify this situation, Heslegrave and Colvin (1998) proposed three components of stress (as a general construct): 1) as a consequence of the individual-environment interaction, 2) in terms of physiological responses, and 3) as what occurs when excessive strain results in collapse. The same construct is defined by Selye (1975) “a syndrome accompanied by objectively measurable somatic manifestations and elicited by a variety of emotional and physical agents” (p. 38). The current research defines stress according to an amalgamation of Heslegrave and Colvin’s (1998) and Selye’s (1975) definitions and chose, for the purposes of the study to define it as “an event that occurs as a consequence of the person-environment interaction that results in measurable outcomes.” As noted previously, the stress response may be a function of personality in that for some, stress is perceived as a performance booster while for others it only hinders performance and makes success virtually impossible.

Although historically castigated in the literature for its harmful effects, views of stress have been increasingly changing. For example, although one aspect of stress has been traditionally viewed as deleterious, another form has been and continues to be lauded for its beneficial properties. These two opposing forms of stress have been termed by Hans Selye (1975) as distress and eustress, respectively. Eustress is viewed as the beneficial component in

that it provides an edge to the individual, which results in distilled concentration, a single-mindedness that enhances and directs the focus of the individual who is experiencing the (eu)stress to the situation at hand. In terms of the Yerkes-Dodson Law, this occurrence would take place at the top of the inverted-U curve, during instances of perceived moderate stress. In other words, eustress coincides with an individuals' peak performance and thus, enhances performance by inducing the fight-or-flight response—a biological phenomenon that results in: heightened senses, improved reflexes, and an increased mental (i.e. memory) and physical (i.e. diminished pain sensitivity; Lundberg, 2006) capacity. Conversely, distress has the opposite effect (Selye, 1975) and is what is being referred to when the term “stress” is used colloquially. Unlike eustress which can improve performance, distress is highly destructive. Bearing in mind the various views on the direction and shape of the stress-performance relationship, the current authors hypothesized the following:

Hypothesis 2: A significant negative correlation will occur between stress and performance.

In an effort to understand the underlying reasons behind reactions to stress and inspired by earlier works, Theorell and Karasek (1996) noted that the cognitive and behavioral effects of work were a function of a combination of the psychological demands placed upon the worker, the amount of influence given to the worker in the decision making process, and in the worker's ability to utilize self-perceived useful skills, a concept that is also known as the Demand-Control Model (Karasek, 1976). Put a different way, distress can result when an employees' subjective assessment of their abilities and usefulness to an organization is at odds with their superiors' view of their talents and value. This is a potentially volatile situation since this inconsistency can result in the superior burdening the subordinate with excessive amounts of work that

surpasses the subordinate's competency level. Conversely, it could result in a failure to provide an adequate challenge to an employee, preventing the use and development of valuable knowledge, skills, or abilities. In fact, research has indicated that the amount of damage experienced due to a lack of demand often supersedes that of low control (de Lange et al., 2003).

Nevertheless, lack of control can also have detrimental effects on performance. In a low or no control situation, employees may experience feelings of helplessness in their inability to either modify their employee's view of their performance or to increase their utility to the organization by enhancing their skill proficiency. Maier and Seligman (1976) make the assertion that "[i]n general, when an organism experiences uncontrollable events, three deficits often ensue: motivational, cognitive, and emotional" (p. 7). Consequently, an employee who is experiencing chronic distress fails to exert maximum effort on their tasks, is at an increased risk of making mistakes, and has a high probability of becoming emotionally unstable. Depending upon the situation (i.e. surgeons, police officers, commercial pilots), the results could be catastrophic. The inclusion of additional stressors such as time constraints and personal accountability (for human life as well as equipment) can trigger higher levels of anxiety in individuals, further impeding their decision-making abilities and, along a similar line, their performance. Roth-Leon and Revelle (1985) suggest that those who experience higher levels of anxiety are less competent in their ability to focus on the task at hand than those who experience lower levels of anxiety. That is to say, individuals who interpret an event as being distressing (i.e. experiencing high anxiety) are more likely have diminished performance in comparison to others who are not distressed (from the standpoint that anxiety is a manifestation of distress). Some individuals, given the exact same circumstances, view it as a welcome challenge, learn from the situation, and retain this knowledge to be utilized in the future. With these differences

in mind, the current research not only proposes that the latter type of individual's superior performance is indicative of higher eustress (the positive manifestation) but that key individual personality characteristics are partially responsible for differential reactions to distress.

Thus, research on the relationship between stress and performance, though controversial, indicates that excessive amounts of stress/strain while beneficial to some, serves to impede performance in others (Flynn & James, 2009; Gallagher, 1990; Nelson & Simmons, 2005; Garnezy & Rutter, 1983). These performance outcomes are influenced by the level of demand placed upon the individual and the amount of control over their circumstances that people are granted. This demand-control ratio is a significant contributor to perceptions of stress. Past research has alluded to the possibility that differences in stress perception are dependent upon individual personality characteristics (i.e. Penley & Tomaka, 2002; Fredrickson, 2001; McGowan et al., 2006; Hurtz & Donovan, 2000; Golby & Sheard, 2004; Horsburgh et al., 2009).

When the brain perceives stress, a cascade of events is triggered in order to prepare the body to respond to the situation (i.e. the fight-or-flight response). One of these events entails the release of specific hormones and neurotransmitters such as Epinephrine and Norepinephrine. According to Lundberg (2006) and Chrousos and Gold (1992), the release of Epinephrine causes an increase in blood flow to the brain, heart, and muscles while the release of Norepinephrine results in the constriction of blood vessels. To clarify, Epinephrine—which is also known as adrenaline (Axelrod & Reisine, 1984)—increases heart rate and Norepinephrine elevates blood pressure. Given that the release of these two hormones is indicative of a physiological stress reaction, a measure of heart rate and blood pressure were included in the study as a way to combat the issues with self-report measures that have been acknowledged in the field (i.e.

validity, response bias, faking, interpretation of results; Spector, 1994). These reactions suggest the following:

Hypothesis 3: (a) Higher levels of PsyCap will be significantly and negatively correlated with self-reported measures of stress and (b) PsyCap will be significantly and negatively related to physiological reactions.

Personality

Personality extends well beyond the facets of PsyCap that have been previously described. In point of fact, few topics have been researched in psychology as aggressively or as frequently as personality. Indeed, the history of psychology is replete with theories of personality as it applies to behavior—from the basic Type A (characterized by high aggression and an increased vulnerability to illnesses such as coronary heart disease; Glass, 1979; Watson, Minzenmayer, & Bowler, 2006; Strube, Berry, Goza & Fennimore, 1985; Takao, Ishihara, & Mori, 2007) and Type B (characterized by the ability to maintain emotional equilibrium and quickly adjust to unexpected circumstances; 1979; 2006; O’Connor, 2002; Singh & Thapa, 1989) behavior patterns, to the Minnesota Multiphasic Personality Inventory (MMPI; Costa & McCrae, 1989; Schuerger, Zarrella, & Hotz, 1989) and the Myers-Briggs Type Indicator (MBTI; Haynes, Tan, & Baker, 1990). The Five Factor Model (FFM) of personality, also referred to as the “Big Five” (Goldberg, 1990) is one of the most widely used classifications in the personality literature, and unlike PsyCap, represent more stable trait characteristics. The five factors are Openness to Experience, Conscientiousness, Extroversion, Agreeableness, and Neuroticism. Each of these factors is comprised of underlying facets; however, only those facets directly related to the current study: anxiety and self-consciousness (Neuroticism) and self-discipline and achievement striving (Conscientiousness) will be highlighted.

The Personality-Stress Relationship

Research has indicated that some personality characteristics are potentially more predictive (by way of anxiety) of increased sensitivity to distress (Grant & Langan-Fox, 2007) while other personality dimensions make individuals more resistant to distress (Fredrickson, 2001; Nelson & Simmons, 2005; Horsburgh et al., 2009; McGowan et al., 2006). Hence, certain personality traits can be said to increase the likelihood of an individual experiencing eustress and being “mentally tough,” a concept that is heavily influenced by the theory of the hardy personality. Those individuals who feel in control of their life and experiences, are committed to being actively involved in their environment, and view changing circumstances optimistically/as a welcome challenge rather than as a hindrance are referred to as embodying the “hardy personality” (Kobasa, 1979; Kobasa, Maddi, & Kahn, 1982; Golby & Sheard, 2004). In keeping with these principles, Horsburgh et al. (2009) used a twin study methodology to obtain results that supported the assertion that personality is, to some extent, heritable and accounts for between-subject differences in mental toughness. Mentally tough individuals are said to display high levels of: control (over everyday events), commitment (active engagement in what one is doing), challenge (the knowledge that change is a regular occurrence that can be adapted to), and confidence (assurance in abilities and the certainty of success; also known as the Four Cs; Horsburgh et al., 2009). This suggests that certain individuals are genetically able to manage distress in such a way that it is transformed into eustress, or conversely, that certain people are *less* resistant to stress and are therefore much more likely to suffer when it occurs.

Past research (Hurtz & Donovan, 2000; Grant & Langan-Fox, 2007; Heslegrave & Colvin, 1998; Penley & Tomaka, 2002; Watson, Minzenmayer, & Bowler, 2006) has found that specific personality traits solicit specific behavioral responses. For example, Neuroticism is

generally associated with negative emotional stress reactions and contributes to the negative situation by the individual venting and engaging in hostile reactions such as physical retribution (i.e. hitting) and avoidance of the situation (i.e. reverse PsyCap self-efficacy). Extroversion and Conscientiousness are thought to represent more rational stress responses in that implementable solutions to the problem are sought and/or created. These subjective, physiological, and behavioral stress reactions are said to be contingent upon individual “cognitive appraisal processes” (Penley & Tomaka, 2002; p. 1217).

In an effort to determine whether the Big Five personality traits were predictive of behavioral responses to stress, Penley and Tomaka (2002) attempted to categorize these response types. Two distinct appraisal methods and their corresponding response patterns were identified: threat appraisals and challenge appraisals. When an individual exceeds his or her ability to effectively handle a situation, a threat appraisal is reached. These appraisals are similar to those found when distress is being experienced: increased anxiety, performance deterioration, and negative emotional reactions (Gallagher, 1990). Conversely, challenge appraisals occur when an individual encounters a potentially stressful situation that s/he feels able to manage (i.e. PsyCap self-efficacy). Rather than allowing the situation to be emotionally or behaviorally destructive, the (di)stressful experience is modified and perceived as (eu)stressful, the necessary behavior adaptations are made, and the individual achieves successful task completion.

To conclude, past efforts have indicated the propensity for certain heritable personality attributes to make individuals naturally more resistant (or susceptible) to eustress (distress) and its benefits (disadvantages). Specifically, elements of Neuroticism and Conscientiousness have been linked to differential interpretations of stimuli as being either eustressful or distressful, challenging or threatening. Conscientiousness is believed to contribute to rational solution

formation (therefore resulting in a challenge appraisal/eustressful condition) while Neuroticism is associated with negative distress reactions (leading to a threat appraisal/distressful experience).

In keeping with this view,

Hypothesis 4: (a) Scores on the Neuroticism and Conscientiousness facets of the NEO PI-R will be negatively correlated with self-reported stress levels and (b) negatively correlated with physiological stress responses

The Personality-Performance Relationship

Given the moderating effect that personality is suggested to have on perceptions of stress coupled with the relationship that is proposed to exist between stress and performance, it follows that certain personality traits—or, in the case of the current research, specific facets of specific personality traits—will be related to performance outcomes.

Neuroticism (anxiety and self-consciousness facets)

As noted earlier, certain personality traits are purportedly able to predict behavior (Nelson & Simmons, 2005; Deluga, 1988; Golby & Sheard, 2004; Baumeister, 1984; van den Berg & Feji, 2003). People able to successfully complete a task while involved in a distressful situation are presumed to share a certain taxonomy of character traits that separates them from those who are less successful under an identical condition (Grant & Langan-Fox, 2007). Grant and Langan-Fox (2007) noted that individuals with certain personality characteristics (e.g. over-fixation, excessive worry) are actually more prone to mental amplification of distressful situations, creating a more severe circumstance than actually exists, thereby further increasing their anxiety. Roth-Leon and Revelle (1985) found that low-anxiety individuals are able to effectively centralize their complete attention on the necessary task (i.e. take advantage of a eustressful situation) whereas high-anxiety individuals must divide their attention and attempt to

split their concentration between task performance and personal concerns. In a study involving bomb disposal operators, Rachman (1991) presented potential evidence for Roth-Leon and Revelle's (1985) supposition by making the observation that operators who had received performance awards (i.e. decorations) self-reported lower levels of anxiety even while experiencing the highest-difficulty portions of the administered stress test. In other words, the success of these individuals indicates their ability to focus on the task at hand without being distracted by extraneous stimuli (i.e. anxiety) is indicative of centralized focus.

Similar to anxiety, self-consciousness can have a negative impact on performance in that the individual splits his/her awareness between completion of the task and, under an evaluative condition, over-concern with the thoughts and opinions of the evaluator(s) and/or spectators. In a study that examined the phenomenon known as “choking” under pressure, where an individual is seemingly incapable of successfully performing a task regardless of the demand that has been placed upon them to do so or their actual ability, Baumeister (1984) found that pressure (either perceived or actual) enhances self-consciousness while simultaneously hindering performance. The author defined pressure as “any factor or combination of factors that increases the importance of performing well on a particular occasion” (p. 610). Baumeister (1984) goes on to suggest that when attempting to complete an exercise while under pressure, an individual can become aware of the importance of successful task completion (as well as the absolute necessity to correctly perform the actions leading up to completion of the task) to such an extent that the individual over-thinks the process, ultimately resulting in lowered performance. In sum, the suggestion is that certain facets of personality—namely the anxiety and self-consciousness facets of Big Five Neuroticism—can help to predict the way in which subjects will react under distressful (e.g. in high pressure, evaluative, anxiety-provoking) situations

Conscientiousness (self-discipline and achievement striving facets)

Much of the extant research on the performance-personality relationship has been skewed toward the prediction of performance in an academic setting (Duckworth & Seligman, 2005; Costa & McCrae, 1992; Hirschberg & Itkin, 1978; Barling & Charbonneau, 1992; Waschull, 2005). Findings from these studies have consistently shown a significant and positive relationship between Conscientiousness and academic achievement. For example, Chamorro-Premuzic and Furnham (2003) conducted an archival study to determine the correlation between the global Big 5 personality dimensions and academic performance on a series of written exams over the course of three years. As anticipated, the most statistically significant (positive) relationship occurred between Conscientiousness and performance across all years followed by Neuroticism (negatively correlated; significant across year two and year three) and Extroversion (also negatively correlated; significant for year one and year three). Of specific interest were the results relating to the Conscientiousness facets: at the $p < .01$ significance level, reported values for achievement striving fell between the 0.25 to 0.37 range, while values for self-discipline fell between 0.22 and 0.27 (for years two and three; the value for year one was 0.13 at the $p < .05$ level).

Barkhoff, Heiby, & Pagano (2007) found that the Conscientiousness facet self-discipline (referred to in the study as self-regulation) was positively correlated with performance in a sports setting in that higher levels of self-discipline resulted in higher performance scores for competitive roller/figure skaters. These results coincide with Barrick and Mount's (1991) finding that Conscientiousness (and by extension the facets underlying this global construct, namely self-discipline and achievement-striving) is positively related to performance across a wide variety of contexts, extending its influence beyond the realm of academic performance. In

an effort to examine the relationship between Conscientiousness and adaptability, LePine, Colquitt, and Erez (2000) found that high levels of Conscientiousness were actually negatively correlated with decision-making ability following an unanticipated change.

Upon further study, the researchers found that the order, dutifulness, deliberation, and (to a much lesser extent) competence facets were responsible for this finding. This probe also resulted in evidence suggesting that individuals who score highly on the remaining facets (self-discipline and achievement striving) do not experience this decrement in decision-making skills as severely. Specifically, higher *achievement striving* scores in the pre-change conditions resulted in more accurate decisions; conversely post-change scores for *self-discipline* were more accurate. In other words, when change occurs, post-change decrements in decision accuracy caused by the achievement striving facet of Conscientiousness will be compensated by the self-discipline facet—as long as the individual scores highly on both (LePine et al., 2000). To summarize, although Conscientiousness has been linked to academic performance, studies have also demonstrated its relationship to performance in a variety of contexts. Certain facets have also been shown to be related to an individual's ability to adapt to changing circumstances and formulate proper solutions to problems that result as a consequence of the new situation. Given that the participants in the current study were subjected to a changing situation (from a low stress condition to a high stress condition) the following hypothesis was suggested:

Hypothesis 5: (a) The Neuroticism and Conscientiousness facets of the NEO PI-R will be significantly and positively correlated with performance in the flight simulator.

Further, based on prior discussions, the following hypothesis was posed:

Hypothesis 6: (a) PsyCap will moderate the relationship between stress and performance and (b) Neuroticism and Conscientiousness will moderate the relationship between stress and performance.

Summary

Although the relationship between stress and performance is one of the most researched subjects in the psychological discipline, the question as to the positive or negative direction of this relationship remains. This topic has generated much debate, with each hypothesized relationship having its supporters and opponents (Jamal, 1984; 2007). This study approached this issue from an alternative view in that the stress-performance relationship was examined from a positive psychology perspective that highlighted the buffering effects that positive emotions and behaviors can have on experiences of stress. In this light, it was suggested that positive trait-like personality characteristics (the Anxiety and Self-Consciousness facet scales of the NEO PI-R Neuroticism factor, and the Achievement Striving and Self-Discipline facet scales of the NEO PI-R Conscientiousness factor) and state-like personality characteristics (Psychological Capital) would moderate performance.

METHOD

Participants

Participants were recruited for the study via the circulation of sign-up sheets in the aviation department at Kansas State University (KSU), Salina. Additional recruitment efforts were made by the researcher via classroom visits and the placement of a sign-up sheet in the aviation control room office. Of approximately 175 students in the four-year professional pilot program at KSU at Salina, 49 students (28%) currently enrolled in or serving as instructor pilots participated in the study, as did one faculty instructor. The data of the faculty instructor was omitted from the final analyses due to being an extreme outlier on age, months of experience, and year in the program, which reduced the final number of participants to 49. Of the remaining participants, approximately 10% were women; therefore, gender was not included as a factor in any of the analyses. The mean age was 22.4 years ($SD = 3.7$; see Table 1), the average number of years enrolled in the KSU aviation program was slightly less than three ($M = 2.7$, $SD = 1.4$), and the majority of participants had achieved at least a Visual Qualification level. Participants' flight experience ranged from 0 to 84 months ($M = 30.2$, $SD = 24.6$), yet 47 out of 49 participants were familiar with Visual Flight Rule (VFR) techniques and procedures. Although 44.9% of participants had yet to earn IFR qualification, all participants were familiar with basic protocol and instrument function in this kind of scenario. As a result of the academic curriculum, all participants had general knowledge of aviation basics (e.g. aircraft electrical systems, maintenance, and airframe systems), aircraft construction, instrument use, and troubleshooting techniques for equipment failure. However, since approximately half of the participants had either yet to earn a license or had only obtained a private license, many of the participants had not yet advanced to a level where they were completely familiar with multi-engine

aircraft/simulators. Forty-one of the participants indicated that they engage in a workout routine at least twice per week ($M = 2.5$, $SD = 1.5$) from 15 minutes to two hours.

Procedures

Upon arrival to the study site 15 minutes prior to entering the simulator, each participant was given a survey packet containing the Kansas State University's Informed Consent Form, a Demographic Information questionnaire (see Appendix A), the Psychological Capital Questionnaire (see Appendix B), the Revised NEO Personality Inventory (see Appendix C), and the modified Stress in General Scale (see Appendix D). At the time that the packets were distributed, the goals of the study were explained, all participant-posed questions were answered, and the informed consent form was signed. A copy of all pertinent contact information for additional questions/issues was provided for each participant. Once all paperwork was completed, and immediately prior to entering the flight simulator, each participant had their heart rate and blood pressure taken via the Omron HEM-780 Automatic Blood Pressure Cuff. The cuff was applied to the left arm so that it rested in the middle of the bicep and the sensor was placed on the inside of the arm and aligned with the participants' middle finger. The cuff was removed prior to the participant entering the simulator. Participants were then provided a sheet either depicting the required traffic pattern with set airspeeds and altitudes (VFR) or a copy of approach plates with set airspeeds (IFR).

Participants then completed either a benign Visual Flight Rules (VFR) event or a stress-inducing Instrument Flight Rules (IFR) event in the flight simulator¹. Prior to the beginning of the study, the order of each condition was randomized by way of having slips of paper with

¹ The simulator was programmed as a Cessna 172P Skyhawk; a single-engine fixed-wing aircraft.

either VFR or IFR written on them placed in a basket and shuffled. The researcher then removed one slip at a time from the basket, with the resulting condition being the first scenario experienced by the first participant, the second slip of paper determined which condition the second participant would experience first, and so forth until all participants received a condition. The Hotseat Chassis Flight Simulator Pilot Pro test model was programmed with the Microsoft® Flight Simulator X program and was designed to provide a flight experience to participants that was as realistic as possible. The simulator included a full-sized pilot seat, yoke, and rudder pedals, similar to an actual aircraft. Although participants were not in an actual cockpit, there were three wrap-around monitors that displayed flight controls (full instrument panel and visual system, electrical, fuel and landing systems) as well as forward and side views of the area outside of the aircraft to create as realistic a scenario as possible. Engine sounds and aircraft warning sounds were also included in the simulator program in an effort to create situations commensurate to an actual flight experience. Immediately upon completion of the first condition of the study (either VFR or IFR), participants' heart rate and blood pressure were retaken. A 10 minute rest period was incorporated between conditions, with blood pressure and heart rate being taken and recorded prior to re-entry into the simulator. This process was repeated immediately after the participant completed the assigned condition. Thus, heart rate and blood pressure were obtained a total of four times per participant. After both conditions were completed and the fourth measure of blood pressure and heart rate were recorded, participants were re-administered the modified Stress in General Scale.

Materials

Demographics

Demographic items included gender, age, class level, number of months of flying experience, type of license, months license has been held, and level of qualification (e.g. instrument qualified) were included in the first portion of the information packet that was provided to each participant. In addition, two questions related to participants working out were asked. These were days per week spent working out and how much time they worked out (see Appendix A).

Psychological Capital Questionnaire (PCQ)

The Luthans, Youssef, and Avolio (2007) 24-item Psychological Capital Questionnaire was used to measure the Psychological Capital (PsyCap) construct. The PCQ (see Appendix B) is designed to assess the four components of PsyCap: hope, self-efficacy, optimism, and resilience, with each component assessed by six items. A sample item for assessing the hope facet is “I can think of many ways to reach my current goals. A sample efficacy item is “I feel confident in representing my work area in meetings with management.” Optimism is measured with items such as “I’m optimistic about what will happen to me in the future as it pertains to work” and a sample resilience item is “I can get through difficult times at work because I’ve experienced difficulty before.” Due to the nature of the participants in the study, the items on the PCQ were modified slightly to be more relevant. For example, “When I have a setback at work, I have trouble recovering from it, moving on” was adapted as “When I have a setback in class/in the flight simulator/flying, I have trouble recovering from it, moving on.” Responses were reported via a 6-point Likert-type scale (1 = “Strongly Disagree, 6 = “Strongly Agree”). In order to maintain a consistent positive direction of responses, three items (13, 20, and 23; see

Appendix B) were reverse coded. Once this was accomplished, responses were summed over all items into one overall PCQ score. Four studies conducted by Luthans, Avolio, Avey, and Norman (2007) to assess the overall PsyCap construct yielded Cronbach alphas = .88, .89, .89, and .89. Each subscale was also evaluated: hope (.72, .75, .80, .76), self-efficacy (.75, .84, .85, .75), optimism (.74, .69, .76, .79), and resilience (.71, .71, .66, .72). The authors recognized the sub-standard levels of internal consistency obtained in the second sample optimism scale (.69) and the third sample resilience scale (.66), yet noted the reliability of the overall PsyCap construct throughout all four studies. Given that the overall PCQ score is more reliable than the individual subscales, this study used the overall PCQ score.

Modified Revised NEO Personality Inventory (NEO PI-R)

Of the available assessments of the five global personality dimensions, this study implemented the widely used Costa and McCrae (1992) revised Neuroticism-Extroversion-Openness Personality Inventory (NEO PI-R) as a way of operationalizing personality. The NEO PI-R divides each of the abovementioned five domains into six identifiable facets. For example, the Neuroticism domain is comprised of the following facets: angry hostility, impulsiveness, depression, vulnerability, anxiety, and self-consciousness (1992). However, for the purposes of the current research, a modified version of the NEO-PI-R was utilized, and only the following facet scales were included: anxiety and self-consciousness (Neuroticism) and self-discipline and achievement-striving (Conscientiousness), for a total of 32 items. Due to copyright permission limitations, only three out of 32 items was able to be reproduced in the current document (see Appendix C). Sample Conscientiousness items are “I strive for excellence in everything I do” and “When I start a self-improvement program, I usually let it slide after a few days.” Statements such as “If I have said or done the wrong thing to someone, I can hardly bear to face

them again” were used to assess the Neuroticism domain. As with the PCQ, negatively worded items (e.g. items 2, 4, 6, and 8) were recoded in order to provide a positive direction for responses. Item responses were then summed to create a total NEO PI-R score. For the remainder of the document, the NEO PI-R will be referred to as Neuroticism/Conscientiousness. High scores will represent low Neuroticism and high Conscientiousness.

Stress in General Scale (modified as Stress Scale)

Stanton, Blazer, Smith, Para, and Ironson’s (2001) 15-item Stress in General Scale was used as a subjective measure of participant distress/eustress. The measurement is comprised of two subscales, Threat and Pressure, which have alpha values from .77 to .83 and .73 to .86, respectively (Stanton et al., 2001). Participants were instructed to indicate their current feelings based on a 3-point scale (1 = This does describe how I am feeling right now, 2 = This does not describe how I am feeling right now, 3 = Unable to decide how I feel right now) of descriptive words/phrases. By recommendation of the authors, the responses on the items were recoded so that items describing how the participant was feeling were designated a “2,” items that failed to describe participants were designated “0,” and those items that the participant was unable to decide on were coded as “1.” In view of the fact that the majority of the items were in a negative direction, five of the items were recoded differently given that they were phrased in a positive direction (items 4, 5, 9, 12, and 14; see Appendix D). For these items, “0” was assigned for affirmative responses, a “2” was designated for negative responses, and “1” represented the items that participants were unable to make a decision about. The items were then summed in order to create one single score; a high score was taken to mean that a high level of stress was being experienced. Sample items used for the assessment of stress are “Pressured to do well” and “Anxious,” while additional sample items included descriptors such as “Feel in control” and

“Tranquil.” It should be noted that this scale was modified in order to be applicable to the current study in that the “in general” was dropped from the title in order to get a measure of how participants will be feeling at the time that the assessment is completed. Also, synonyms for the original words/phrases were used that are more relevant to the study.

Omron HEM-780 Blood Pressure Monitor with Comfit Cuff

The Omron blood pressure (BP) monitor is designed to determine blood pressure levels by taking three separate measurements and automatically providing an average. Participants were informed not to eat, smoke or exercise for at least 30 minutes prior to using this equipment since all of these activities can result in higher than normal BP levels. The monitor was also used to assess and record participant heart rate. For both the heart rate information and blood pressure, the differences between pre- and post-condition measurements were used. According to the monitor’s manufacturer, the blood pressure reading is accurate to within 2% and heart rate readings are accurate to within $\pm 5\%$.

Performance

Two conditions were created for the purposes of this study: a lower-difficulty visual flight approach (VFR) scenario which took place in optimal weather conditions (clear and calm), and a higher difficulty instrument-only flight approach (IFR) which included the addition of only a half mile visibility and a ceiling that was overcast at 200 feet. For each condition, performance was initially measured in four ways: 1) according to the number of altitude errors that were made within the glidepath (maintaining the proper altitude), 2) according to the number of course deviation errors that were made within the glidepath (maintaining the proper heading), 3) the researcher’s rating of performance, and 4) whether the participant crashed the plane. Since it was impossible to actually crash the Cessna, a “crash” was recorded if either of the following

conditions occurred: if a participant was either unable to land the plane on the correct runway, landed the plane somewhere other than the runway, or (in the case of the IFR condition) the participant was unable to complete the scenario within the 15 minute time allotment. One feature of the Microsoft® Flight Simulator X program is a “Flight Analysis” option that allows for a vertical and horizontal view of the aircraft’s flight pattern, with the glidepath depicted as a green, angled V-shape. Using this output, the researcher was able to divide the vertical glidepaths in both the VFR condition and the IFR condition into six, equidistant points. At each point, a vertical (error) line was drawn to intersect both sides of the glidepath. If, at any of the error lines, the path of the aircraft intersected or was above the top of the glidepath, or intersected or was below the bottom of the glidepath, an error was counted.

This process was repeated with the horizontal glidepath with one major difference: rather than an error being counted if the path of the aircraft was above or on the uppermost boundary/below or on the lower boundary, errors were counted if the path of the aircraft was either to the left or on the left leg of the glidepath or to the right or on the right leg of the glidepath. Although both conditions had a maximum of six vertical (altitude) errors that could be made, the VFR condition only allowed for a maximum of four course deviation errors and the IFR condition had a maximum of five course deviation errors. The reason for this is due to the difference in the length of the glidepaths. The total number of each type of error (altitude and course deviation) was summed to create two performance scores per condition: VFR altitude errors, VFR course deviation errors, IFR altitude errors, and IFR course deviation errors.

For the researcher’s performance rating, a grading sheet was created (see Appendix E) using criteria inspired by the Training Integration Management System (TIMS) grade sheet that is used for USAF and US Navy pilot training. Participants were scored on nine factors: airspeed

control, altitude control, general knowledge, course maintenance, situational awareness/headwork, constant descent, communication, task management, and overall performance. Each of the above factors were scored on a 0-3 scale (0 = crashed/failed, 1 = unsatisfactory, 2 = good, 3 = excellent) for a possible 27 points. It should be noted that in order to earn a “good” rating on airspeed and altitude, participants had to be within 10 knots (kts; nautical miles per hour) of the designated speed or 100 feet (ft) within the specified altitude. An “excellent” rating was awarded if participants were able to be within 5kts or 50ft of the specified airspeed or altitude, respectively. For the “maintains course” and “constant descent” factors, less than a $\frac{3}{4}$ scale deflection was rated as “good” while less than $\frac{1}{4}$ scale deflection was established as an “excellent.”² As for the crash rating, those who were able to successfully complete the flight and land the plane were scored “0” whereas those who did not have a successful flight and/or were unable to land the plane on the runway were scored a “1.”

RESULTS

Prior to any analyses being conducted, we first sought to determine exactly how to operationalize the criterion. Given that there were two different conditions, we had to establish whether or not to use all of the performance scores (the number of altitude and course deviation errors, the rater-given performance score, and whether the participant crashed or not) individually or to combine these four measures into one overarching score. Beginning with the VFR (lower difficulty condition) data, the course deviation error and participant crash scores showed no variability. Taken in conjunction with highly skewed distributions, the low

² This criterion was only used in the IFR condition since participants were able to maintain their course and descent visually when flying the VFR traffic pattern.

variability of these two measures of performance resulted in neither one being included as part of the final VFR performance score. Since these two errors were not correlated, the rater performance and altitude error scores were each kept as performance measures for the lower difficulty condition.

Next, the IFR (higher difficulty condition) data for the four performance measures was examined. Given the significant correlations that were found to exist among all four measures (altitude and course deviation error scores, the rater performance score, and the crash score in the lower difficulty condition; r s ranging from .48 to .84), a factor analysis was conducted and resulted in all four measures loading on a single factor that accounted for 75% of the variance. Therefore, the course deviation and altitude errors, the rater performance score, and whether the participant was successful at landing the plane or crashed were all combined into one overall IFR performance score. It should be noted, however, that each of the measures were scored on different scales. In order to account for this, all four measures were standardized prior to being summed into one overall IFR score.

Once the criterion was established for both conditions of the study, the number of predictors was examined. Considering the study's small sample size and the resultant small number of degrees of freedom, the goal was to minimize the number of predictors. As previously mentioned, gender was dropped as a predictor due to the limited amount of female participants in the study. Age and year in the program were significantly correlated ($r = .43, p < .01$). A much higher correlation resulted between months of experience and the following demographic information: year in the program, highest license earned, and qualification level achieved ($r = .67, .77, \text{ and } .72$, respectively, $p < .01$). Consequently, given that months of experience were highly correlated with all of these variables, it was retained as the only

demographic control variable. As expected, number of hours and days spent working out were significantly correlated; however, given their lack of relationship with the criterion, they were also dropped from the final analysis. Therefore, of these eight variables, “months of flying experience” was chosen as the only demographic variable to include in the regression. For the purposes of the study, personality was operationalized in terms of Neuroticism/Conscientiousness scores and PsyCap scores since they were not significantly correlated ($r = -.06, p = \text{n.s.}$). As a result, both were used as the second set of predictors. The final set of predictors were the following measurements of stress: the differences between pre- and post-VFR heart rates and blood pressures, the differences between higher difficulty condition heart rates and blood pressures, and participants’ self-reported post-stress scores. The differences between each condition’s pre- and post-heart rates and blood pressures was taken given the significant correlations between pre- and post-levels (heart rate $r_s \approx .85, p < .001$; blood pressure $r_s \approx .79, p < .01$) Although pre- and post-stress levels were similar ($M_{\text{pre}} = 5.98, M_{\text{post}} = 5.69$), the decision to include only post-stress total scores was reached in light of the lack of any significant correlation of pre-condition stress scores with any of the criterion variables.

Means, standard deviations, and correlations amongst all of the retained variables of interest are depicted in Table 2 (lower difficulty condition) and Table 3 (higher difficulty condition). The tables contain the same means, standard deviations, and correlations except for the performance scores.

The purpose of this study was to better ascertain the relationship between experience, stress, and personality on the performance criterion. In order to accomplish this task, a series of three hierarchical regressions were conducted. For the first regression, the number of altitude errors made by participants in the easier, VFR condition served as the criterion. On

account of its role as a potential covariate with performance, months of flying experience was entered as the first step of the regression. Both personality measures were entered into the next step; the third and final step consisted of all three measures of stress (both physiological measures and self-reported post-condition stress levels). Table 4 displays the standardized regression coefficients (β) for the predictors at each step of the regression. As evident in this table, none of the steps resulted in a significant beta value, meaning that Hypothesis 1 received no support as far as the first measure of performance in the VFR condition. That is, none of the predictors were successful in predicting the number of altitude errors participants would make in the lower difficulty condition.

The order of entry for the predictors in the second hierarchical regression was identical to the first: the number of months of flying experience was entered first, then PCQ and the Neuroticism/Conscientiousness scores. Lastly, the differences between pre- and post-condition heart rate and blood pressure and post-condition stress scores were entered. Each of these was regressed onto the criterion, VFR rater performance. These results showed support for the second portion of Hypothesis 1 in that PCQ scores emerged as a significant predictor of rater-determined performance scores in the VFR condition ($\beta = -.26, p < .05$; see Table 5). Following the exact same pattern of entry, the final regression differed only in the criterion, which was in this case the composite score for the IFR, or more difficult, condition. The results failed to show any support for Hypothesis 1 insofar as the PCQ being a significant predictor of performance in the IFR condition ($\beta = -.06, p = \text{n.s.}$; see Table 6). The results of a zero-order correlation provided partial support for Hypothesis 2 in that rater performance scores for the VFR and composite scores for the IFR were significantly correlated with self-reported stress levels ($r = -.60, p < .01$ and $r = -.50, p < .01$, respectively; see Table 2 and Table 3). Although participant

post-condition stress level was not a significant predictor of VFR vertical errors made, it surfaced as a significant predictor for VFR rater performance scores ($\beta = -.51, p < .001$) as well as performance in the IFR condition ($\beta = -.40, p < .05$; see Table 5 and Table 6). Hypothesis 3 was also partly supported: no significant correlation was found between either of the physiological measures of stress (heart rate and blood pressure) and PsyCap for either condition of the study. However, a significant negative correlation did exist between PsyCap and self-reported stress in both VFR ($r = -.29, p < .05$) and IFR ($r = -.29, p < .05$) conditions. Hypothesis 4 failed to receive any support whereas Hypothesis 5 achieved partial success. Although the Neuroticism/Conscientiousness facets were unable to predict performance in either of the VFR conditions, performance in the IFR condition was successfully predicted ($\beta = -.26, p < .05$), only in a direction opposite than expected (see Table 6). Our final hypothesis (Hypothesis 6) was unable to be tested in light of multicollinearity issues.

To summarize, Hypothesis 1 received partial support since, at the zero-order level no significant correlation was evident between PCQ scores and performance in the lower difficulty condition; yet in the higher difficulty scenario, this score was positively correlated with performance at a significant level. A hierarchical regression revealed the predictive ability of the PCQ was limited to that of rater scores in the lower difficulty condition. Hypothesis 2 also received partial support. A significant, negative correlation was only found to exist between self-reported post-stress levels and rater scores (less difficult condition) and overall performance (more difficult condition); a significant relationship did not occur with physiological measures. The self-report measure of stress was also the only significant predictor of rater performance scores in the less difficult condition and overall performance in the more difficult condition. While scores on the PCQ were found to be significantly, negatively correlated with self-reported

stress levels, the same did not occur with physiological stress measures, meaning that Hypothesis 3 also received partial support. Whereas no support was found for Hypothesis 4, Hypothesis 5 received mixed support. No correlation was evident between the Neuroticism/Conscientiousness facets and any of the performance scores. Further testing revealed that in spite of its lack of predictive ability to determine performance in the lower difficulty condition, the Neuroticism/Conscientiousness score emerged as a significant predictor of performance in the higher difficulty condition. Hypothesis 6 was unable to be tested due to issues with multicollinearity.

Discussion

The goal of this study was to investigate the relationship between stress and performance while controlling for certain individual characteristics. Participants were subjected to two realistic flight simulation scenarios. This task allowed for the manipulation of weather conditions to stimulate different difficulty (stress) levels while taking both objective and subjective measures of performance. The following sections will discuss: the outcomes for each of the specific hypotheses, interpretations of these outcomes in light of relevant past research, and summarize the implications of each finding. Limitations of the study and areas for future research will also be outlined.

Stress and Performance

Hypothesis 2, which proposed a relationship between stress and performance that is in line with the findings of Jamal (2007), Muse et al. (2003), and Searle et al. (1999)—that high stress levels hamper performance, received partial support. At the zero-order level, a significant negative correlation became apparent (in the low-stress setting) between self-reported stress and rater scores and, in the high-stress situation between self-reported stress and overall performance.

Attempts to obtain a similar result with the physiological stress measures (heart rate and blood pressure) in either condition were unsuccessful. Further regression analyses revealed that after controlling for experience, personality, and physiological measures of stress, post-condition stress levels contributed to the prediction of rater-determined performance in a low-stress setting and overall performance on the high difficulty flight scenario. Our final hypothesis indicated the possibility that the effects of stress on performance levels would be dependent upon personality characteristics. However, because of the study's small sample size, this hypothesis could not be analyzed. Further, testing for the presence of a curvilinear relationship was also problematic due to the small sample size.

Personality and Stress

Hypothesis 3, which suggested a negative relationship between PsyCap and stress, also received partial support. Due to stress being operationalized in three ways, three different outcomes were possible: those for heart rate, blood pressure, and post-stress levels. Whereas neither of the physiological measures was significantly correlated with PsyCap in either the low- or high-stress condition, at the zero-order level post-condition stress scores shared a negative, significant relationship with PCQ scores. For the purposes of this study, another definition of personality was in terms of participant scores on four facet scales of the NEO PI-R that were designed to tap into either Conscientiousness or Neuroticism (self-discipline and achievement, anxiety and self-consciousness, respectively); all four facet scales were combined into one score. No significant relationship was evident between Neuroticism/Conscientiousness scores and either of the lower difficulty condition stress scores (physiological or self-reported). Similar results occurred for the higher difficulty condition; neither measure of stress resulted in a significant relationship with Neuroticism/Conscientiousness scores (Hypothesis 4).

Personality Characteristics and Performance

From a positive psychology perspective, the relationship between more positive personality characteristics and participants' ability to perform well while engaged in stressful situations was tested (Hypothesis 1). At the zero-order level, no support for Hypotheses 1 was found. However, when combined with the other study predictors (regression analysis) PsyCap was found to contribute to the prediction of performance in the less stressful condition. The addition of lower experience and stress to higher positive views led to decreased performance: a counter intuitive finding. One possible interpretation is that the higher positive views led to overconfidence on the pilots' part. That is to say, in a lower-stress situation, novice pilot trainees with stronger positive views about themselves appeared to either overestimate their abilities or underestimate the actual difficulty of the situation. This finding is surprising but may help us to understand some of the past problems with determining the relationship between individual traits and states and performance (e.g. Westman & Eden, 1996; Golby & Sheard, 2004; Haynes et al, 1990; Heslegrave & Colvin, 1998; Watson et al., 2006).

When a combination of more traditional personality characteristics was examined (Hypothesis 5), it was also found that these traits were also not related to performance. Both of these findings were inconsistent with previous research. Viewed in this light, positive personality characteristics should have enhanced psychological processes (e.g. focus), and resulted in an increase in performance scores. Given the plethora of research findings supporting the relationship between the revised NEO PI-R and stress (e.g. Barrick & Mount, 1991; Zhao, Seibert, & Lumpkin, 2009; Poropat, 2009), the absence of support for Hypothesis 5 was unexpected. A possible explanation for this is that previous studies examining this relationship used the NEO PI-R in its entirety as opposed to focusing on specific facet scale scores.

Hypothesis 6 suggested that personality would have a moderating effect on the relationship between stress and performance. However, preliminary analysis uncovered multicollinearity problems that are most likely the result of the study's small sample size. Consequently, the interaction term was omitted from the final step in the regression and this hypothesis could not be tested.

Hypothesis 5 also failed to find support since participant Neuroticism/Conscientiousness scores were not correlated with any of the three performance measures. Again the hierarchical regressions yielded some very interesting results related to personality characteristics. First, the predictive ability of personality on performance was dependent upon the stress level of the task and pilot experience. For the lower difficulty condition, performance was assessed according to participants' ability to remain within the recommended altitudes and airspeeds as the aircraft approached for landing. For the higher difficulty condition, performance was evaluated based upon a more complex set of factors such as: altitude consistency, course maintenance, flight completion, and ratings. At this level, our second hypothesis suggesting a positive relationship between personality and performance was partially supported. When holding all other variables constant, participants' Neuroticism/Conscientiousness score was a significant predictor of the IFR composite performance scores. Stated differently, pilot trainees with more experience, with higher anxiety levels, and higher level levels of perceived stress were less prone to making mistakes in the higher difficulty condition. Again, on the surface, these findings seem counter intuitive. One possible explanation is that more experience pilots in a stressful situation who express more general anxiety tendencies, may be better able to perform since the greater anxiety helps them to avoid errors.

Overall, this study found that the role that personality plays in performance appears to be dependent upon task difficulty (i.e. lower difficulty versus higher difficulty), level of experience, and self-reported stress. For those who were less experienced and report more stress, positive personality characteristics such as higher self-efficacy and lower anxiety seem to be more of a hindrance to performance in that these characteristics create a false sense of ability, potentially resulting in lack of maximum effort and lower performance. Thus, positive characteristics are related to performance under stress only when tempered by experience. This finding is in accordance with Campbell et al.'s (1993) theory of performance. The authors indicate that job performance is determined by the following three major components: 1) declarative knowledge, 2) procedural knowledge and skill, and 3) motivation. Personality components and self-knowledge are explicitly included in the authors' conceptualization of declarative knowledge. In terms of this study, it appears that the PCQ and the Neuroticism/Conscientiousness facets may be serving as a self-knowledge component as well as motivation. Clearly, experience and psychomotor skills are factors of procedural knowledge and skill; factors that undoubtedly came into play in the simulator scenarios. Despite the fact that Campbell et al. (1993) did not include stress as part of the motivation component, it can be considered as such.

In support of the Campbell Model, Hesketh and Neal (1999) note, "furthermore, ability and experience predict declarative and procedural knowledge, while personality constructs predict motivation" (p.24). From this perspective, it is easy to see how the relationships between and among these components (personality, experience, and ability) can result in either an increase or decrease in task performance. Experience is plainly an essential element of performance. Campbell (1993) and Anderson (1985) both suggest the potential irrelevance of ability alone in completing a task. That is, ability without experience is useless.

Summary and Implications

Considering that stress and its relationship to performance have been researched for decades, evidence that the two are linked is in abundance (e.g. Yerkes & Dodson, 1908; Seyle, 1975; McGowan et al., 2006; Maier & Seligman, 1976). The crux of the issue lies in the direction (positive or negative) and shape (linear or curvilinear) of this relationship (Jamal, 2007; Westman & Eden, 1996; Eid & Morgan, 2006). We attempted to look beyond whether stress is beneficial or harmful to performance, seeking instead to determine if personality moderated this relationship. That is, in terms of the inverted-U shape, whether personality influences the location of the optimal function-performance decrement threshold. Unfortunately, due to the small sample size we were unable to test this relationship directly on account of multicollinearity issues. However, we did find that personality was a significant predictor of performance when experience and stress levels were considered. Given the nature of this study, we were unable to make any statements related to causality. We also found that in easier situations, high positive personality characteristics in the less-experienced can result in an overestimation of proficiency, resulting in decreased performance accuracy. The same results can be interpreted for more difficult, higher stress tasks rather instead of an exaggerated sense of skill, a lack of mental preparedness/vigilance resulted in lower performance scores in comparison to more experienced individuals.

Future research should focus on a more in-depth examination of the eustress/distress distinction and its relationship between personality and performance. The use of a different self-reported stress scale—one that actually looks at specific eustress and distress indicators—is recommended. Given the issues with using heart rate and/or blood pressure to determine participant stress levels, other objective measures should be used (e.g. cortisol levels, etc.).

Limitations

Given the nature of the population of interest, obtaining a large sample size on a college campus proved difficult and also created a major limitation for the study. The most prevalent problem in this particular study was the multicollinearity issue that we encountered which prevented full testing of all hypotheses. Another limitation involves the simulator that was used. Although a 180° view was possible via three wrap-around screens, the fidelity of the simulator screen images was lacking. In fact, many of the participants commented that the simulator felt more “like a videogame” than an actual flight experience. Although the cost of a more advanced simulator would be exponentially higher, a similar increase in fidelity would also result. A final limitation of the study was the use of a novice rater to obtain the rater performance scores. While a certified flight instructor was provided, this expert was present for less than half of the participants. It is suggested that future researchers use at least two expert raters for more a potentially more accurate performance assessment.

Conclusions

When examining a career such as being a pilot that is consistently high risk with high responsibility, the fact that there is no room for self-doubt is understandable, as is the benefit of positive visualization. However, when these selfsame traits cause an underestimation of a situation’s difficulty or a false sense of competence, the results can prove costly and even (in the case of pilots) fatal. Although we were unable to determine the moderating ability of personality on the stress-performance relationship, the implication that rather than positive characteristics attenuating the corrosive effects of stress on performance in less experienced pilot trainees could reveal a possible link that has thus far been overlooked in the stress-performance literature. The

results of this study strongly suggest the importance of the task. The results clearly were differentiated based upon whether performance occurred on a low or high difficulty task.

Table 1

Descriptive Statistics, Means (M) and Standard Deviations of Demographic Variables (N = 49)

	<i>%</i>	<i>M</i>	<i>SD</i>
Age		22.4	3.9
Gender		--	--
Female	10.2		
Male	89.8		
Year in KSU Aviation Program		2.7	1.4
First Year	28.6		
Second Year	20.4		
Third Year	16.3		
Fourth Year	26.5		
Fifth Year+	8.2		
Level of Qualification		--	--
None	12.2		
Visual	32.7		
Instrument	55.1		
Highest License Earned		--	--
None	18.4		
Private License	24.5		
Instrument	10.2		
Commercial License	4.1		
Certified Flight Instructor, Instrument	6.1		
Multiengine License	26.5		
Certified Flight Instructor, Multiengine	10.2		
Months of Flying Experience		30.2	24.6
Days per Week Spent Working Out		2.5	1.5
Workout Time (minutes)		88	58

Table 2

Means (M), Standard Deviations (SD), Reliability Coefficients, and Intercorrelations for VFR condition (N = 49)

	<i>M</i>	<i>SD</i>	<i>α</i>	1	2	3	4	5	6	7a	7b
1. Months of Flying Experience	30.2	24.6	--	--							
2. Psychological Capital Questionnaire ^a	111.0	10.5	.83	.44**	--						
3. Neuroticism/Conscientiousness	91.0	9.6	.70	.13	-.06	--					
4. Heart Rate (HR ₂ -HR ₁) ^c	1.3	7.3	--	.12	.04	.04	--				
5. Blood Pressure (BP ₂ -BP ₁) ^c	4.6	10.2	--	.10	.17	-.09	.06	--			
6. Post-Condition Stress ^d	5.7	5.2	.78	-.40**	-.29*	-.19	.20	-.01	--		
7. Performance											
a. Altitude Errors ^e	3.76	1.36	--	-.06	-.01	.04	-.04	.15	.01	--	
b. Rater Performance ^e	18.7	4.5	--	.49**	.06	.13	-.08	-.11	-.60**	-.18	--

**p < .05(one-tailed); **p < .01(one-tailed); ^a high scores = positive personality characteristics; ^b high scores = low Anxiety/high Conscientiousness; ^c high scores = increase in HR/BP; ^d high scores = high post-condition stress level; ^e high scores = high performance*

Table 3

Means (M), Standard Deviations (SD), Reliability Coefficients, and Intercorrelations for IFR condition (N = 49)

	<i>M</i>	<i>SD</i>	<i>α</i>	1	2	3	4	5	6	7
1. Months of Flying Experience	30.2	24.6	--	--						
2. Psychological Capital Questionnaire ^a	111.0	10.5	.83	.44**	--					
3. Neuroticism/Conscientiousness	91.0	9.6	.70	.13	-.06	--				
4. Heart Rate (HR ₂ -HR ₁) ^c	.32	6.9	--	-.11	-.06	.18	--			
5. Blood Pressure (BP ₂ -BP ₁) ^c	4.8	9.0	--	-.05	.01	-.07	.20	--		
6. Post-Condition Stress ^d	5.7	5.2	--	-.40**	-.29*	-.19	.10	-.15	--	
7. IFR Performance ^e	0.0	3.5	--	.50**	.25*	-.10	.04	.15	-.50**	--

* $p < .05$ (one-tailed); ** $p < .01$ (one-tailed); ^a high scores = positive personality characteristics; ^b high scores = low Anxiety/high Conscientiousness; ^c high scores = increase in HR/BP; ^d high scores = high post-condition stress level; ^e high scores = high performance

Table 4

Hierarchical Regression for VFR Altitude Errors (N = 49)

Predictors	Step 1	β^a	
		Step 2	Step 3
Months of Flying Experience	-.06	-.08	-.08
PCQ ^b		.03	.04
Neuroticism/Conscientiousness		.05	.04
VFR Heart Rate (HR ₂ -HR ₁)			-.02
VFR Blood Pressure (BP ₂ -BP ₁)			-.15
Post-Stress			-.02
F	.19	.11	.22
ΔF	.19	.07	.34
R ²	.004	.007	.03
ΔR^2	.004	.003	.02

* $p < .05$; a = Standardized Beta Weights; b = Psychological Capital Questionnaire; c = Neuroticism/Conscientiousness facets of the NEO

Table 5

Hierarchical Regression for VFR Rater Performance Score (N = 49)

Predictors	Step 1	β^a	
		Step 2	Step 3
Months of Flying Experience	.49**	.57**	.42*
PCQ ^b		-.19	-.26*
Neuroticism/Conscientiousness		.04	-.05
VFR Heart Rate (HR ₂ -HR ₁)			-.02
VFR Blood Pressure (BP ₂ -BP ₁)			-.11
Post-Stress			-.51**
F	15.13**	5.69*	7.16**
ΔF	15.13**	.98	6.53**
R ²	.24	.28	.51
ΔR^2	.24	.03	.23

* $p < .05$; ** $p \leq .001$; a = Standardized Beta Weights; b = Psychological Capital Questionnaire; c = Neuroticism/Conscientiousness facets of the NEO PI-R

Table 6

Hierarchical Regression for IFR Performance (N = 49)

Predictors	Step 1	β^a	
		Step 2	Step 3
Months of Flying Experience	.49**	.51**	.41*
PCQ ^b		.02	-.06
Neuroticism/Conscientiousness		-.17	-.26*
VFR Heart Rate (HR ₂ -HR ₁)			.15
VFR Blood Pressure (BP ₂ -BP ₁)			.06
Post-Stress			-.40*
F	14.98**	5.53*	5.19**
ΔF	14.98**	.85	3.82*
R ²	.24	.27	.43
ΔR^2	.24	.03	.16

* $p < .05$; ** $p < .001$; a = Standardized Beta Weights; b = Psychological Capital Questionnaire; c = Neuroticism/Conscientiousness facets of the NEO PI-R

REFERENCES

- Anderson, J. R. (1985). *Cognitive psychology and its implications* (2nd ed.). New York: Freeman.
- Axelrod, J. & Reisine, T. D. (1984). Stress hormones: Their interaction and regulation. *Science, New Series*, 224(4648), 452-459.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Barkhoff, H., Heiby, E. M., & Pagano, I. S. (2007). Self-regulation skills of a competitor type vs. a training champion athlete in artistic roller skating: A season long case study in elite sport competitions. *Athletic Insight: The Online Journal of Sport Psychology*, 9(2), 43-57.
- Barling, J. & Charbonneau, D. (1992). Disentangling the relationship between the achievement striving and impatience-irritability dimensions of type a behavior, performance, and health. *Journal of Organizational Behavior*, 13, 369-377.
- Barrick, M. R. & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, 44, 1-26.
- Baumeister, R. F. (1984). Choking under pressure. *Journal of Personality and Social Psychology*, 46(3), 610-620.
- Becker, D. & Marecek, J. (2008). Positive psychology: History in the remaking? *Theory & Psychology*, 18(5), 591-604.
- Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. In N. Schmitt, W. C. Borman, & associates (Eds.), *Personnel Selection in Organizations* (pp. 35-70). San Francisco: Jossey-Bass.
- Chamorro-Premuzic, T. & Furnham, A. (2003). Personality traits and academic examination

- performance. *European Journal of Personality*, 17, 237-250.
- Christopher, J. C., Richardson, F. C., & Slife, B. D. (2008). Thinking through positive psychology. *Theory & Psychology*, 18(5), 555-561.
- Chrousos, G. P. & Gold, P. W. (1992). The concepts of stress system disorders: Overview of behavioral and physical homeostasis. *Journal of American Medical Association*, 267, 1244-1252.
- Costa, P. T. & McCrae, R. R. (1989). More reasons to adopt the five-factor model. *American Psychologist Special Issue: Children and Their Development: Knowledge Base, Research Agenda, and Social Polic.*, 44(2), 451-452.
- Costa, P. T. & McCrae, R. R. (1992). Revised NEO personality inventory and NEO five-factor inventory: Professional manual. Odessa, FL: Psychological Assessment Resources.
- de Lange, A. H., Taris, T. W., Kompier, M. A. J., Houtman, I. L. D., & Bongers, P. M. (2003). “The very best of the millennium”: Longitudinal research and the demand-control-(support) model. *Journal of Occupational Health Psychology*, 8(4), 282-305.
- Deluga, R. J. (1988). The politics of leadership: The relationship between task-people leadership and subordinate influence. *Journal of Organizational Behavior*, 9, 359-366.
- Duckworth, A. L. & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, 16(12), 939-944.
- Duckworth, A. L., Steen, T. A., & Seligman, M. E. P. (2005). Positive psychology in clinical practice. *Annual Review of Clinical Psychology*, 1, 629-651.
- Flynn, N & James, J. E. (2009). Relative effects of demand and control on task-related cardiovascular reactivity, task perceptions, performance accuracy, and mood. *International Journal of Psychophysiology*, 72, 217-227.

- Fredrickson, B. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist, 56*(3), 218-226.
- Gable, S. L. & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology, 9*(2), 103-110.
- Gallagher, D. J. (1990). Extraversion, neuroticism and appraisal of stressful academic events. *Personality and Individual Differences, 11*(10), 1053-1057.
- Garnezy, N. & Rutter, M. (1983). *Stress, coping, and development in children*. New York: McGraw-Hill.
- Glass, D. C. (1979). Stress, behavior patterns, and coronary disease. *American Journal of Clinical Biofeedback, 2*(2), 81-91.
- Golby, J. & Sheard, M. (2004). Mental toughness and hardiness at different levels of rugby league. *Personality and Individual Differences, 37*, 933-942.
- Goldberg, L. R. (1990). An alternative “description of personality”: The big-five factor structure. *Journal of Personality and Social Psychology, 59*(6), 1216-1229.
- Grant, S. & Langan-Fox, J. (2007). Personality and the occupational stressor-strain relationship: The role of the big five. *Journal of Occupational Health Psychology, 12*(1), 20-33.
- Haynes, C. J., Tan, S.-Y., & Baker, M. W. (1990). Missionary assessment: norm comparison and prediction of perseverance. *Review of Religious Research, 32*(2), 173-178.
- Hesketh, B. & Neal, A. (1999). Technology and performance. In D. R. Ilgen & E. D. Pulakos (Eds.), *The Changing Nature of Performance* (pp. 21-55). San Francisco: Jossey-Bass.
- Heslegrave, R. & Colvin, C. (1998). The potential utility of psychophysiological measures as selection tools. *The Journal for the Society for Human Performance in Extreme*

- Environments*, 3(1), 121-139.
- Hirschberg, N. & Itkin, S. (1978). Graduate student success in psychology. *American Psychologist*, 33, 1083-1093.
- Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). A behavioural genetic study of mental toughness and personality. *Personality and Individual Differences*, 46, 100-105.
- Hurtz, G. M. & Donovan, J. J. (2000). Personality and job performance: the big five revisited. *Journal of Applied Psychology*, 85(6), 869-879.
- Jamal, M. (1984). Job stress and job performance controversy: An empirical assessment. *Organizational Behavior and Human Performance*, 33, 1-21.
- Jamal, M. (2007). Job stress and job performance controversy revisited: An empirical examination in two countries. *International Journal of Stress Management*, 14(2), 175-187.
- James, W. (1994). *The varieties of religious experience*. New York: Modern Library. (Original work published 1902)
- Karasek, R. A. (1976). *The impact of the work environment on life outside the job* (Report No. DLMA 91-25-75-17-1). U.S. Department of Labor, Manpower Administration: Washington, D. C. (ERIC Document Reproduction Service No. ED142717)
- Kobasa, S. C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology*, 37(1), 1-11.
- Kobasa, S. C., Maddi, S. R., & Kahn, S. (1982). Hardiness and health: A prospective study. *Journal of Personality and Social Psychology*, 42(1), 168-177.
- Lazarus, R. S. (2003). Does the positive psychology movement have legs? *Psychological*

- Inquiry*, 14(2), 92-109.
- LePine, J. A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: effects of general cognitive ability, conscientiousness, and openness to experience. *Personnel Psychology*, 53(3), 563-593.
- Lundberg, U. (2006). Stress, subjective and objective health. *International Journal of Social Welfare*, 15(suppl. 1), S41-S48.
- Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological capital: Measurement and relationship with performance and satisfaction. *Personnel Psychology*, 60, 541-572.
- Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital* (pp. 237-238). New York: Oxford University Press.
- Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital: Developing the human competitive edge*. Oxford, UK: Oxford University Press.
- Maier, S. F. & Seligman, M. E. P. (1976). Learned helplessness: Theory and evidence. *Journal of Experimental Psychology: General*, 105(1), 3-46.
- Maslow, A. (1971). *The farthest reaches of human nature*. New York: Viking.
- McGowan, J., Gardner, D., & Fletcher, R. (2006). Positive and negative affective outcomes of occupational stress. *New Zealand Journal of Psychology*, 35(2), 92-98.
- Muse, L. A., Harris, S. G., & Feild, H. S. (2003). Has the inverted-U theory of stress and job performance had a fair test? *Human Performance*, 16, 349-364.
- Nelson, D.L. & Simmons, B.L. (2005). Eustress and attitudes at work: A positive approach. A. Antoniou and C. Cooper (Eds.). *Research Companion to Organizational Health Psychology*. pp. 102-110. Edward Elgar Publishing Limited, Cheltenham, UK.

- O'Connor, J. (2002). Type a, type b and the Kleinian positions: Do they relate to similar processes? *Psychoanalytic Psychology, 19*(1), 95-117.
- Penley, J. A. & Tomaka, J. (2002). Associations among the big five, emotional responses, and coping with acute stress. *Personality and Individual Differences, 32*, 1215-1228.
- Rachman, S. J. (1991). *Final report: Psychological analyses of courageous performance in military personnel*. United States Army Research Institute for the Behavioral and Social Sciences. Washington, DC (NTIS No. AD-A241 226).
- Roth-Leon, M. & Revelle, W. (1985). Effects of anxiety on analogical reasoning: A test of three theoretical models. *Journal of Personality and Social Psychology, 49*(5), 1302-1315.
- Schuerger, J. M., Zarrella, K. L., & Hotz, A. S. (1989). Factors that influence the temporal stability of personality by questionnaire. *Journal of Personality and Social Psychology, 56*(5), 777-783.
- Seligman, M. E. P., Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14.
- Selye, H. (1975). Confusion and controversy in the stress field. *Journal of Human Stress, 37*-44.
- Singh, A. K. & Thapa, K. (1989). Type a behaviour pattern and coronary heart disease: A demographic study. *Indian Journal of Clinical Psychology, 16*(1), 9-12.
- Spector, P. E. (1994). Using self-report questionnaires in OB research: A comment on the use of a controversial method. *Journal of Organizational Behavior, 15*, 385-392.
- Stanton, J. M., Blazer, W. K., Smith, P. C., Parra, L. F., & Ironson, G. (2001). A general measure of work stress: The stress in general scale. *Educational and Psychological Measurement,*

61(5), 866-888.

- Strube, M. J., Berry, J. M., Goza, B. K., Fennimore, D. (1985). Type a behavior, age, and psychological well-being. *Journal of Personality and Social Psychology*, 49(1), 203-218.
- Takao, M., Ishihara, N., & Mori, T. (2007). Morning-evening type and stress-related personality in Japanese college students. *Perceptual and Motor Skills*, 104, 687-690.
- Theorell, T. & Karasek, R. A. (1996). Current issues relating to psychosocial and cardiovascular disease research. *Journal of Occupational Health Psychology*, 1(1), 9-26.
- van den Berg, P. T. & Feij, J. A. (2003). Complex relationships among personality traits, job characteristics, and work behaviors. *International Journal of Selection and Assessment*, 11(4), 326-339.
- Waschull, S. B. (2005). Predicting success in online psychology courses: Self-discipline and motivation. *Teaching of Psychology*, 32(3), 190-192.
- Watson, W. E., Minzenmayer, T., & Bowler, M. (2006). Type a personality characteristics and the effect on individual and team academic performance. *Journal of Applied Social Psychology*, 36(5), 1110-1128.
- Westman, M., & Eden, D. (1996). The inverted-U relationship between stress and performance: A field study. *Work and Stress*, 10(2), 165-173.
- Yerkes, R. M. & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology*, 18, 459-482.

Appendix A - Demographic Information

Participant No.:

Age (in years): _____

Gender (mark X one): ___Female ___Male

Class Level (please circle one):

First Year Second Year Third Year Fourth Year Fifth Year +

Months of Flying Experience: _____

Please indicate (mark X) which (if any) of the following licenses you have obtained:

1. Private License _____
2. Instrument License _____
3. Commercial License _____
4. Certified Flight Instructor Instrument _____
5. Multiengine _____
6. Other (full title; no acronyms, please):

What level of qualification have you achieved (mark X one): visual _____ instrument _____

How many days (on average) do you work out per week? _____

When you work out, how long (on average) do you work out? _____

Appendix B - Psychological Capital Questionnaire

Gallup Leadership Institute

Participant No.: _____

Date: _____

Instructions: Below are statements that describe how you may think about yourself **right now**. Use the following scale to indicate your level of agreement or disagreement with each statement.

Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6

- | | |
|---|-------------|
| 1. I feel confident analyzing a long-term problem to find a solution. | 1 2 3 4 5 6 |
| 2. I feel confident in representing my performance in meetings with instructors/faculty. | 1 2 3 4 5 6 |
| 3. I feel confident contributing to discussions during class instruction. | 1 2 3 4 5 6 |
| 4. I feel confident helping to set targets/goals for myself. | 1 2 3 4 5 6 |
| 5. I feel confident contacting people outside the class (e.g., other instructors, head of the KSU Aviation Department) to discuss problems. | 1 2 3 4 5 6 |
| 6. I feel confident presenting information to a group of colleagues. | 1 2 3 4 5 6 |
| 7. If I should find myself in a jam, I could think of many ways to get out of it. | 1 2 3 4 5 6 |
| 8. At the present time, I am energetically pursuing my training goals. | 1 2 3 4 5 6 |
| 9. There are lots of ways around any problem. | 1 2 3 4 5 6 |
| 10. Right now I see myself as being pretty successful in training. | 1 2 3 4 5 6 |
| 11. I can think of many ways to reach my current aviation training goals. | 1 2 3 4 5 6 |
| 12. At this time, I am meeting the goals that I have set for myself. | 1 2 3 4 5 6 |
| 13. When I have a setback in class/in the flight simulator/flying, I have trouble recovering from it, moving on. | 1 2 3 4 5 6 |
| 14. I usually manage difficulties one way or another during training. | 1 2 3 4 5 6 |
| 15. If I have to, I can be “on my own,” so to speak, when flying. | 1 2 3 4 5 6 |

16. I usually take stressful flight situations in stride. 1 2 3 4 5 6
17. I can get through difficult times in training because I've experienced difficulty before. 1 2 3 4 5 6
18. I feel I can handle many things at a time during flight situations. 1 2 3 4 5 6
19. When things are uncertain for me in class/in flight simulator/in the air, I usually expect the best. 1 2 3 4 5 6
20. If something can go wrong for me training-wise, it will. 1 2 3 4 5 6
21. I always look on the bright side of things regarding my training process. 1 2 3 4 5 6
22. I'm optimistic about what will happen to me in the future as it pertains to flying. 1 2 3 4 5 6
23. As a trainee, things never work out the way I want them to. 1 2 3 4 5 6
24. I approach pilot training as if "every cloud has a silver lining." 1 2 3 4 5 6

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Appendix C - Revised NEO PI-R (modified)

(Costa & McCrae, 1992)

Participant No.: _____

Date: _____

Instructions: Below are statements that describe how you may think about yourself. Use the following scale to indicate your level of agreement or disagreement with each statement.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1	2	3	4	5

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 19. | When I start a self-improvement program, I usually let it slide after a few days. | 1 | 2 | 3 | 4 | 5 |
| 23. | I strive for excellence in everything I do. | 1 | 2 | 3 | 4 | 5 |
| 31. | If I have said or done the wrong thing to someone, I can hardly bear to face them again. | 1 | 2 | 3 | 4 | 5 |

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Appendix D - Stress Scale (Modified)

(Stanton et al., 2001)

Instructions: For each of the following words and phrases, please circle:

“1” if it **does** describe how you are feeling right now; “2” if it **does not at all describe** how you feel right now; or “3” if you are **unable to decide**.

	This does describe	This does not at all describe	Unable to decide
a Anxious	1	2	3
b Pressured to do well	1	2	3
c Disorganized	1	2	3
d Calm	1	2	3
e Tranquil	1	2	3
f Worried about performance	1	2	3
g Agitated	1	2	3
h Annoyed	1	2	3
i Feel in control	1	2	3
j Upset	1	2	3
k Stressed	1	2	3
l Comfortable	1	2	3
m More stressed than I'd like	1	2	3
n Competent	1	2	3
o Overwhelmed	1	2	3

Appendix E - Simulator Rater Performance Measure

Participant No.: _____ **Rater** _____ **Date:** _____

Instructions: For each of the following items, please indicate (mark **X**) your ratings for each condition. Space has been provided below for any additional comments.

Condition: VFR				
Handling of Controls/ Instrument Procedures	Fail	Unsatisfactory	Good	Excellent
Airspeed Control				
Altitude Control				
General Knowledge				
Maintaining Course	Crashed/Failed	Significant Deviations	Minor Deviations	Little (if any) Deviations
Maintains Course				
Situational Awareness/Headwork				
Constant Descent				
Communication				
Task Management				
Overall Performance				
Condition: IFR				
Handling of Controls/ Instrument Procedures	Fail	Unsatisfactory	Good	Excellent
Airspeed Control				
Altitude Control				
General Knowledge				
Maintaining Course	Crashed/Failed	Significant Deviations	Minor Deviations	Little (if any) Deviations
Maintains Course				
Situational Awareness/Headwork				
Constant Descent				
Communication				
Task Management				
Overall Performance				

Comments/notes during the flights for your ratings: