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Performance And Motivation Of Pre- And Early-Career Professional Pilots

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PERFORMANCE AND MOTIVATION OF PRE- AND EARLY-CAREER PROFESSIONAL PILOTS

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Nicholas David Wilson
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ABSTRACT

The path from student pilot to professional aviator is lengthy, expensive and full of obstacles (Philips, 2016, Wilson & Daku, 2016). An individual pilot's motivations to persevere and ultimately succeed within this field are yet to be clearly defined. Two motivation theories, Social Cognitive Theory (SCT) (Bandura, 1986) and Self-Determination Theory (SDT) (Deci & Ryan, 1985) may inform our understanding the connection between motivation and performance. Through three studies of a program of research, the researcher investigated relationships between distinct types of motivation and performance within the applied discipline of Aviation and Airline Pilot career performance.

To begin the research, we evaluated a set of exploratory variables focused on perspectives of airline managers and training personnel on newly hired airline pilots ($N = 37$). This study offered us better understanding of relationships between individual variables associated with subscales of professionalism and technical knowledge as new hire pilots transition into their career. From this study, the researchers expanded into Study 2 ($N = 229$) which focused on potential causal relationships between motivation and academic performance. The researchers evaluated several motivation subscales and their relationship to mean exam score in a senior-level technical course, finding a student's self-efficacy to be most predictive of academic outcome. Within Study 3 ($N = 204$), the researchers sought to better understand if a student's enrollment within two distinct course delivery methods of a senior-level technical course may influence what type of motivation they exhibit. This study included subscales on

Intrinsic Motivation, Identified Motivation, Introjected Motivation, Externally Regulated Motivation, and Amotivation (Vallerand et al., 1992). The study found no differences between individual motivation subscales of students enrolled in blended versus online asynchronous course offerings. Taken together, the study findings contribute to the research literature on how today's aviation students engage in learning and how their individual motivations towards learning may influence outcome on aircraft technical assessments. This information may serve to inform how they may perform during entrance into the airline career path. Airline and aviation management personnel who have influence over recruitment, hiring, training and development of new hire pilots may find this information useful as they consider how to design recruitment and training programs. Future research should address study limitations by expanding data collection to other institutions and aviation training delivery outside of collegiate aviation.

PERFORMANCE AND MOTIVATION OF PRE- AND EARLY-CAREER PROFESSIONAL PILOTS THREE-ARTICLE DISSERTATION

The pathway from curious learner to professional pilot has changed in the last decade. The changes have been driven by a combination of regulatory, economic, and demographic shifts (Lutte, 2018; Lutte & Mills, 2019; Wilson & Daku, 2016). One example of such change that precipitated the recent pilot shortage occurred in 2007 when the Fair Treatment for Experienced Pilot's Act (2007) extended the mandatory age of retirement from 60 to 65 and postponed retirements and delayed career progression for some pilots earlier in the pipeline. During a similar timeframe, the global economy suffered one of the most significant contractions in recent history, diminishing demand for air travel (Scovel, 2012). Coincidentally, during the early phases of the economic recovery, the crash of Colgan 3407 in Buffalo, NY killed all passengers and crew as well as one person on the ground (NTSB, 2009). The tragic accident of the Colgan 3407 accident triggered a comprehensive review of pilot experience requirements, duty, and rest requirements (FAR 117), and fatigue risk management (FRM) at commercial carriers. One of the more prominent examples of such changes included a statutory increase to the minimum flight experience requirements for new aviators to enter the discipline under Public Law 111-216 (Airline Safety and Federal Aviation Administration Extension Act of 2010). Although limited statutory relief exists for military pilots and graduates of approved collegiate programs, the minimum hours of pilot experience increased from 250 to 1500 hours with additional training requirements before issuance of required FAA certification.

During years following the Great Recession, aviation experts predicted a dramatic increase in the need for qualified pilots (Higgins et al., 2013). This rise in pilot demand can be attributed to economic expansion as well as the contributory effects of delayed retirements through Public Law 110-135 as well as the lack of hiring and career progression during the Great Recession (Higgins et al., 2013; B. Lutte, 2017; Pearce, 2012; Scovel, 2012).

The combination of factors, from regulatory shift, to economic recession followed by increase in demand for air travel, also created significant shifts in pilot recruitment strategies in a very short timeframe (Lutte, 2018). During this period of change, pre-career pilots (collegiate aviation students) began to see more choices in their regional airline career options. Examples of such factors evolved to include increased base salaries, generous hiring bonuses, defined career pathway programs and guaranteed interviews with major carriers (Lutte & Lovelace, 2016; Regional Airline Association, 2019; Samost, 2018). Acknowledged by one regional airline CEO, this extreme competition for qualified pilots ostensibly led to recruitment of candidates whom may be qualified against the more stringent FAA qualifications, but whom lack technical and professional knowledge and subsequently fail to complete regional pilot training (Lutte & Lovelace, 2016).

The confluence of these many factors in the aviation industry led the current research to ask, how did this unique spike in demand for qualified pilots impact or influence the professional readiness of the pilots entering the trade? This overarching research question, informed by emergent research and the researcher's own experience as an instructor in airline pilot training, created an impetus to engage on the current program of study. To gauge perceptions of management and instructors at a regional airline, the researcher conducted an initial study (Study 1) to assess professional readiness and technical proficiency of early-career pilots (Wilson &

Daku, 2016). The researcher subsequently completed studies on motivational factors associated with technical (systems) performance (Study 2), as well as assessment of motivation within different classroom delivery methods with pre-career professional pilots (Study 3). A summary of the studies is below.

Program of Research

Study 1, *Industry in Motion: Pilot Study on Instructor and Management Perceptions of New Hire Pilot Technical and Professional Preparation* sought to establish a baseline for the program of study using direct industry feedback on early-career aviators. The study was conducted under IRB and regional airline company approval. The study evaluated responses of 37 airline personnel involved in the initial training of new-hire pilots. The technical knowledge subscale and professionalism subscale both showed high reliability at $\alpha=0.87$ and $\alpha=0.91$, respectively. Three individual variables showed strong, statistically significant correlation with each other. The variables included *(1) "Perceived knowledge of airline procedures and operations", (2) "Perceived communications with ATC", (3) "Perceived ability to use company manuals and procedures."* This study formed the foundation for subsequent research of collegiate student motivation and relationship to academic performance in an advanced technical (aircraft systems) course. The text of this publication is reprinted within this document.

Study 2, *Assessing Motivation as Predictors of Academic Success in Collegiate Aviation Classrooms* sought to understand the relationship between motivation and technical proficiency (academic outcome). The purpose of the study was to evaluate responses of 229 senior-level collegiate aviation students on five motivational constructs: intrinsic motivation, career motivation, self-determination, self-efficacy, and grade motivation. The study also evaluated potential associations between these motivation constructs and academic outcome. The data suggests an individual's self-efficacy as a strong predictor of cumulative exam score. The results of this study inform our understanding of motivational characteristics of pre-career professionals and how they may relate to academic outcome within a technical systems course. The manuscript of this study is complete and will be submitted for publication post-defense.

Study 3 is titled *Examining Differences in Aviation Student Motivation during Blended Versus Online Asynchronous Courses*. Informed by Self-Determination Theory (Ryan & Deci, 2000), the researcher assessed 204 senior-level aviation students' responses to the Academic Motivation Scale (AMS; Vallerand et al., 1992). The second purpose of the research was to evaluate student motivation in two different delivery methods of an advanced systems (technical) course; a blended (flipped) course design and an online asynchronous course design. By assessing for differences in motivational characteristics between delivery methods, the researcher intended to determine whether students whom enroll in one delivery method or another may exhibit evidence of self-selection bias and which may indicate other underlying characteristics important for airline curriculum design and initial career transition. Statistical evidence does not support differences between students included in the two course delivery methods on any of the motivational subscales included in the AMS. This information suggests students included in the study, at this university, do not differ meaningfully nor show selection bias into one course delivery method versus another. This study manuscript is near completion and may be submitted for publication in the near future.

Each of the research efforts are presented below with greater detail and within the larger context of motivation and technical preparation with early and pre-career pilots.

Study 1: Airline Industry Professionals' Perceptions of Early-Career Pilots

Feedback from industry leadership highlights the challenges with recruiting, training, and retaining qualified pilots. In some cases, regional airlines are hiring pilots whom have the required experience but lack other technical or professional knowledge required to be successful and persevere in their career paths (Lutte & Lovelace, 2016). Unfortunately, a paucity of related research existed at the time of the study, which presented an opportunity. The purpose of this research was to address the gap in research into airline training professional's perceptions of new-hire (early career) pilots as they entered their first professional pilot job at a regional airline in the United States.

Method

The researchers conducted an online survey of regional airline's flight operations training and management personnel involved in training early-career pilots. Determination of the study's focal concepts was informed by Glaser and Strauss' (1967) Grounded Theory as well as the work of Self-Determination Theory (Ryan & Deci, 2000). Using concept mapping informed by their industry experience, researchers generated two survey sub-scales, the first focused on the general themes of technical proficiency (seven items) and the second on professionalism (six items) within the pilot career (included in publication). The online Qualtrics survey was distributed via email using a list of instructors and company management personnel. One design characteristic of the survey was to assess perceptions of the new-hire pilots as they progressed to three different sequential levels, or phases of interaction, within their initial airline training program. Prior to distribution of the survey, approval was received from the regional airline company management along with Institutional Review Board (IRB) approval from UND.

The source of the data included flight operations training management, classroom and simulator instructors as well as line check airmen performing operational experience (OE) line training. The research entailed collecting quantitative survey data focusing on new hire pilots' professionalism and technical proficiency from the perspective of the airline employee providing the training and/or early career interactions (e.g., management).

Results

We performed an exploratory factor analysis (EFA) on the data using Statistical Package for Social Science (SPSS; IBM, 2017). The results of the EFA suggested two factors: professionalism and technical knowledge. The two individual themes of technical knowledge and professionalism were further evaluated for inter-item correlations. Examples of strong, positive statistically significant correlations were (1) "Perceived knowledge of airline procedures and operations", (2) "Perceived communications with ATC", (3) "Perceived ability to use company manuals and procedures." Discussion of additional correlations are included in the publication. The two sub-scales were evaluated for construct validity and showed high reliability with technical knowledge (Cronbach's $\alpha = .87$) and professionalism (Cronbach's $\alpha = .91$).

Discussion

The study evaluated two categories of perceptions – on technical knowledge and professionalism. The outcomes of the survey were expected to illustrate areas where additional pilot training and preparation were required, earlier in the training pipeline, typically the collegiate aviation pathway. Additionally, the survey results were expected to illustrate current perceptions of new pilot trainees, at an aggregate level, as they progressed through initial qualification training at their regional airline.

These results provide a snapshot of the current state of professional and technical preparation of the new-hire pilot class at the partner airline. The information provided in Study 1 is could inform collegiate aviation institutions or other training providers on potential curriculum modifications which could better prepare new-hire candidate in advance of hire at the first airline. A potential limitation of the first study was understanding how *motivations* of the pre-career pilots may contribute to the responses furnished by airline personnel during subsequent initial qualification training. Study 2 seeks to provide insight into the relationships between motivation and academic performance (demonstrated technical knowledge via course exams) of these pre-career aviation students.

Study 2: Motivation and Academic Performance of Pre-Career Collegiate Aviation Students

The airline industry has changed significantly in the last two decades. A partial list of such changes include regulatory changes to pilot retirement age, increase to first officer qualifications and a pilot shortage (Boeing, 2019; Lutte, 2018; Lutte & Lovelace, 2016; Wilson & Daku, 2016). These events culminated in an acute demand for qualified pilots, rising wages and creating hiring incentives. Within the context of this unprecedented demand for qualified pilots, the study will investigate motivation within the next generation of aviation professionals. The purpose of the study was to investigate which forms of motivation of collegiate aviation students predict academic performance within a fourth-year advanced aircraft systems course.

Method

The researcher adapted the Science Motivation Questionnaire II (Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011) to an advanced fourth-year technical course on “aircraft systems”. Individual survey items within each motivation construct were mixed and provided in a semi-random order to each participant via the online Qualtrics survey tool. The survey instrument was provided to the students after approximately 75% of course content had been covered (14th week for full semester or 5th week for summer session). Missing data were handled using similar response pattern matching (SRPM; Byrne 2016) and represented less than 0.2% of the dataset. A total of (N = 229) students responded to the survey, of which 12.7% were female (N = 29). Individual responses were matched with students' composite exam scores for the course. Using AMOS, a structural equation modeling (SEM) was created with the five motivation scales of the *Science Motivation Questionnaire II* predicting students' final course grade to better understand students' motivations and their relationships (or absence thereof) to academic performance within an advanced technical knowledge course.

Results

Each of the five motivational constructs from the established questionnaire were evaluated for scale reliability using SPSS. Each scale showed good internal reliability: Intrinsic (α = .84), Career Motivation (α = .89), Self-Determination (α = .83), Self-Efficacy (α = .86), and Grade Motivation (α = .88). To evaluate the SMQ-II within the collegiate aviation discipline, the researcher first completed an exploratory factor analysis (EFA) which yielded a five-factor solution, significantly aligned with the original SMQ-II.

Using the statistical software AMOS, the researcher completed a confirmatory factor analysis (CFA) as well as a structural equation model (SEM) including academic outcome (average course exam score) as endogenous variable. During the CFA, data was evaluated for construct validity, convergent validity, and discriminant validity. Analysis of the structural model identifies strong regression coefficients between self-efficacy and academic outcome. This result aligns with expectations regarding existing motivation theory. Less expected outcomes were noted between intrinsic motivation and academic outcome as well as career motivation and academic outcome. During analysis of discriminant validity, evidence for multicollinearity on selected latent constructs create potential for alternate statistical explanations for the SEM.

Discussion

Analysis of the data in the present study suggest expected relationships between self-efficacy with academic performance, which would align with established motivation theory (Bandura, 1986). As the students in this research are studying advanced aircraft systems for aircraft which they could expect to fly during the course of their careers, it would be reasonable to expect a high degree of intrinsic and career interest in the material. In contrast, regression weights in the structural model show a strong negative relationship between intrinsic motivation and academic outcome and a weak negative relationship from grade motivation to academic outcome. SEM results also suggest a lack of expected relationship between career motivation and academic outcome. Further discussion is included in Study 2.

The second study informs our understanding of student motivation towards academic outcome, however, leaves opportunity for additional analysis. What is not understood is role the course delivery method may have on student motivation. Additionally, whether differences exist between student groups whom enroll in blended, face-to-face delivery methods versus those whom enroll in online, asynchronous methods.

Study 3: Assessing Aviation Student Motivation in Blended and Online Asynchronous Course Delivery

Technical knowledge of aircraft systems is critical to the effective performance of a professional pilot. As evidence of the importance of technical knowledge, an airline pilots' technical knowledge is evaluated at several points during their initial qualification (IQ) pilot training as well as at least annually through what is referred to as continuing qualification (CQ) or otherwise known as *recurrent training*. In recent years, the growing availability of online and "distance learning" tools have changed how education and technical training are provided to aviation professionals, as well as the general population.

Established research has shown there are typically differences in students whom enroll in online-only courses versus those whom select traditional methods (Deming et al., 2015; Money & Dean, 2019; Nguyen, 2015). This research outlines several attributes of online learners who tend to desire more flexibility in how they learn, often as a result of career or family obligations which are balanced concurrently with education. For the pilot already established in the career path at an airline, he or she has little or no choice as to how this training is received and how they can develop and maintain their technical knowledge. However, collegiate aviation students are provided more options in this scenario as they approach this challenging part of their academic careers.

Under the scope of this study, the researchers sought to evaluate whether there are any differences in motivational attributes between students who choose a blended, face-to-face learning method or an entirely online asynchronous method. The purpose of the research is to evaluate whether one course delivery method versus another attracted students with different motivational characteristics across five different subscales of the adapted Academic Motivation Scale (Vallerand et al., 1992). The expected outcome of the study is to evaluate whether differences existed and attempt to further understand possible explanations for differences through the lens of Self-Determination Theory (SDT; Ryan & Deci, 2000). Secondarily, as professional pilots are not typically given choice as to how they learn technical knowledge (e.g. aircraft systems) during initial and recurrent pilot training, this research serves to establish a baseline for later research as to how collegiate aviation students may approach training as they progress into the next chapter of their careers.

Method

The researcher invited 243 students enrolled in a senior-level advanced aircraft systems course to participate in a Qualtrics online survey on motivation. The target population included seven sections of a blended design and two sections of an online, asynchronous design of the course. A total of 243 participants were invited to participate, of which 204 responded, yielding an 83.9% response rate. The students involved in this study ($N = 204$) were given the option of enrolling in a blended, face-to-face environment ($n = 162$) or entirely online, asynchronous methods ($n = 43$).

The instrument used in the study was adapted from the Vallerand et al. (1992) Academic Motivation Scale (AMS). The survey instrument was comprised of five constructs each containing four manifest variables assessing types of motivation: Intrinsic, Identified, Introjected, External, and Amotivation. Students were provided the survey online via Qualtrics survey tool after completion of approximately 75% of the academic term.

Results

The researcher first tested for any notable demographic differences within the sample populations (e.g. age, GPA and ACT score). In other research environments, the populations enrolled in online only courses tended to exhibit demographic differences compared with courses offered face-to-face (Deming et al., 2012; Nguyen, 2015). In the case of the present research, almost no difference existed between the blended and online groups with respect to mean age (22.1, 22.2), reported ACT score (25.7, 25.8), reported GPA (3.45, 3.51) and year in school. A slight difference in gender composition of the courses showed lower female enrollment in the blended method (11.7%) versus online (18.6%), although with the relatively low proportion of female students in the online method, one or two more female students can greatly influence percentages.

Although the scales had been slightly modified to account for the change in discipline (to aviation), no changes were made to question stems. Yet, a comparison of scale reliability to the original AMS (Vallerand et al., 1992) results reliability may be useful to assess for potential problems in question wording. In addition to analysis of scale reliability, assessment of construct, discriminant and convergent validity was completed during a CFA. During analysis of the data, the findings suggest (1) the adapted AMS scale reliable for use within the aviation discipline and (2) there were no statistical differences in motivational attributes between the students enrolled two delivery methods of the course as observed through constructs included within the adapted AMS instrument.

Discussion

A student choosing one course delivery method over another could indicate underlying motivational differences in pre-career aviators in how they interact with learning difficult material or how they may choose to interact with peers in the process. Previous research into online education suggests potential for differences in characteristics of students whom typically enroll in online education versus those enrolling in traditional delivery methods (Money & Dean, 2019). Potential differences may be meaningful to management and training personnel to understand and apply in airline and corporate training departments. Final analysis suggests that dissimilar to existing research into online education, the students involved in this study had (1) few demographic differences between the course delivery methods, and (2) exhibited no statistically significant differences within the adapted AMS data.

Summary

The program of research sought to address the motivation and performance of pre- and early-career pilots. This body of research can support the changing needs of the aviation industries in several meaningful ways. As the next generations of aviation professionals enter the discipline, management and recruiting personnel must continually evaluate the motivations of such candidates and future employees. Additionally, as we consider how training and education evolve with greater use of online and distance education methodologies, educators and industry must continue to evaluate if these methodologies fit the students' needs. Prior research suggests mixed experiential and academic outcomes for students engaging in online education (Deming et al., 2015; Nguyen, 2015; Richardson et al., 2017) yet availability of online education continues to grow (Seaman et al., 2018). In the case of the aviation and airline environments, collegiate aviation students may embark on one of many possible academic or preparatory pathways into the discipline, yet the end goal must support the professional and technically proficient pilot.

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STUDY 1

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INDUSTRY IN MOTION: PILOT STUDY ON INSTRUCTOR AND MANAGEMENT PERCEPTIONS ON NEW HIRE PILOT TECHNICAL AND PROFESSIONAL PREPARATION

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Cover Page Footnote

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Industry in Motion: Pilot Study on Instructor and Management Perceptions on New Hire Pilot Technical and Professional Preparation

The aviation industry and airlines are in a perpetual state of change. This comes as a surprise to no one. On both a micro- and macro-scale, these changes are a result of many contributing factors ranging from legislative amendments, terrorism, normal and abnormal economic cycles and consumer expectations for service level and reliability. A subset of these changes, mostly at the airline customer service level, have been rather benign, including paying for a checked bag, or getting that same checked bag free with the use of the associated airline's credit card. Other changes in the industry have resulted in entire sections of the industry nearly disappearing or substantial renovations of training methodologies or new hire attraction and retention measures. With the institution of the "1500-hr rule" (Aeronautical Experience - Airplane Category Restricted Privileges, 2013) and FAR 117 (Flight and Duty Limitations and Rest Requirements: Flight Crew Members, 2014), airlines, collegiate aviation institutions, and other sources of pilot supply have been forced to implement substantial changes to the overall landscape of pilot supply including how to staff, train and retain. What has not received as much attention and are the demographic considerations of the pilot supply itself? How is this new generation of pilots motivated? What types of issues are they facing during their respective transitions into the industry which are different from previous generations of new entrants into the field? How do these changing motivations and transitional factors influence how they are prepared both as a professional in the field and the technical knowledge they demonstrate during initial qualification? This pilot study – of pilots – is intended to serve as a foundation for future research, using the perceptions of airline instructors of their new hire pilots during initial qualification.

Background

If one spends any length of time with an educator it does not take long for the conversation to turn towards a lamentation about how poorly prepared students are for each lesson. This concern is exacerbated when there is a greater generational gap between the educator and the student. According to Twenge (2009), “Many faculty members believe that the students in their classrooms today behave very differently than they themselves did, back in the ‘good old days’ when they were students” (p. 399). Often the educator has a feeling about student preparation that is expressed by stating, “...students these days just don’t spend enough time reading…:” or, “...these kids spend too much time playing video games…” or even worse, “...students are so disrespectful these days, they ask questions that just aren’t appropriate”. It is apparent that there is considerable bias on the behalf of the educator described in these situations - or at least it is apparent to the students.

It is not uncommon that these same sentiments are expressed outside of the formal education environment in the so called “real world” of corporate education. During the course of this study, the authors focused on the perceptions of educators and students within the field of aviation specifically, the regional airline training program. The educators in this study have varying roles within the training environment. A new hire training process at a regional airline is very much a progression from basic skills and knowledge acquisition to advanced training procedures which eventually leads to on-the-job training done during normal line operations. At each of these phases of training, there are new educators that specialize in the skills and concepts within each phase. As the new hire progresses through the training program, they are trained and evaluated by a different instructor or set of instructors. Additionally, as the new hire progresses through the program the expectation is that they become more independent and competent to fill their eventual role as a crew member of a transport category aircraft. This means that the initial phases of instruction will develop foundational knowledge and skills and will involve more direct instruction and a small amount of evaluation. As the new hire progresses through the training program the amount of direct instruction decreases and the instructor takes on the role of an examiner of knowledge and skill. The final stage of the training program, called Initial Operating Experience or IOE, is almost entirely a consolidation and evaluation of procedures, technical skills, and systems knowledge acquired earlier in the training footprint.

State of Regional Airline Pilot Hiring

The airline industry is suffering from a pilot shortage that is affecting regional airline staffing. According to recent research on pilot supply, “For the years 2013 to 2031, there is a forecasted 35,059 pilot shortage. It should be noted that all forecasts lose accuracy over longer periods of time simply due to changing macro conditions.” (Higgins, J., Lovelace, K., Bjerke, E., Lounsberry, N., Lutte, R., Friedenzohn, D., Craig, P., 2013). The pool of qualified airline pilot candidates has been depleted to the point that some regional airlines are not able to fill their new hire classes with enough airline pilots to maintain proper aircraft staffing. As reported in a recent article in Time, “When Republic Airways, a top regional airline, filed for bankruptcy in February, it in part blamed a lack of pilots.” (Fitzpatrick, 2016). This is a stark contrast to the airline pilot hiring landscape leading up to the Great Recession, in which there were many more pilots seeking jobs than there were flight deck seats to fill. It is not within the scope of this study to discuss the cause of this shortage however, it is important contextual information that influences the present study.

AABI Accredited Schools

The Aviation Accreditation Board International (AABI) is a leadership and accreditation board that certifies aviation education programs all over the world (AABI, 2016). An AABI accredited school has met a defined set of standards and continues to maintain and improve upon these standards on an ongoing basis. The accreditation process assures students and future employers that the educational programs meet an industry standard of quality. As a result, graduates of AABI- accredited institutions are given some relief in the flight hour requirements required to become an airline pilot. In a traditional airline new hire classroom, the new hire cadre may have received their pilot training from one of several possible tracks ranging from Part 61 private instruction, military, Part 141 (non-AABI accredited), Part 141 (AABI/University), and in some cases training and experience received in a foreign country. Within the context of this study, it is important to understand the variety of candidates which may be entering the training footprint

Airline Pilot Training Process

Once a new hire pilot begins training for their new role as an airline pilot, they are introduced to and mentored by a variety of airline employees, within and outside of the training organization. The first group of employees the new hire will primarily interact with at a regional airline are the ground school instructors. The ground school instructors provide foundational instruction on general topics such as company policies and procedures, as well as specific technical topics relating to aircraft systems for the airplane that the new hire will be flying.

Once the student has completed initial indoctrination ground training, they proceed to aircraft specific training in general subjects, aircraft systems, flight training devices (FTD) and full motion flight simulators. This training is provided by other members of the regional airline training program. Upon completion of the flight training, the new hire is evaluated by another member of the training program called an Aircrew Program Designee (APD). Finally, the new hire progresses to in-aircraft training which is called operating experience (OE). This training is conducted during normal, revenue-generating, line operations and is done by a qualified training captain, often referred to as an OE Line Check Airman (flight operations training employee, personal communication, August 20, 2015).

Each of these members of the training program provide a unique perspective with respect to the new hire pilot. By surveying a random sampling of each of these members, it is possible to identify both professional and technical knowledge maturation of the new hire as they progress in the training environment from the very beginning with the ground school instructors to the very end with the OE Line Check Airmen. Additionally, these members are observing different skills and knowledge as well as different modalities (for example declared knowledge or psychomotor skills).

Grounded Theory (GT)

The researchers in this study, having experience as either the recipients or providers of training (or both) within the airline industry and presently as educators within a collegiate aviation environment observed certain characteristics of their peers, trainees and instructors while in the airline training pipeline. These traits created a set of ideas regarding the characteristics necessary for success within the airline training initial qualification footprint. These general characteristics were roughly categorized as the new-hire pilot's observed level of (1) technical knowledge and (2) professionalism, however the instructor's role was also important to the outcome. The traits of the trainee can either be partially attributed to the individual (motivation, innate ability) or gathered through the educational footprint (Part 61, 141, collegiate, military, etc.) as the individual progressed into the airline career. As there was limited research and no specific pre-established theoretical framework, the researchers took an exploratory approach with the intention to expand the body of knowledge relating to new-hire pilot preparedness and success in a method similar to Glaser & Strauss' Grounded Theory of research (1967). One unique difference in this foundational research as that the respondents of the study were not the new-hire pilots themselves, but the instructors and management whom have influence over the pilot and their progress through the training pipeline. This is where GT is applicable. As noted in a recent publication focusing on GT:

> ''All is data.'' It's true that it doesn't really matter what type of data you are using, but you do need to understand that the data are gathered for a reason—that is, to allow the process of theoretical sampling to occur. In other words, you collect slices of data, analyze the data, and—based on that analysis—decide on the next wave of data gathering. (Walsh, Holton, Bailyn, Fernandez, Levina, & Glaser, 2015, p. 586)

Based on the results discussed below, it is anticipated that next phases of research will include interaction, expanded demographic data on both the instructors and new-hire pilots and include a larger group of respondents whom are involved in the training and mentoring of the next generation.

Study Purpose

The present study examined the level of preparedness and professionalism of new hire airline pilot candidates as perceived by a convenient sampling of management personnel, ground instructors, flight simulator instructors, and pilot examiners who are responsible for the new hire training and evaluation process at a regional airline in the United States. Of specific interest for this study was new hire technical knowledge relating to aircraft systems and company procedures and new hire professionalism. A primary objective of this pilot study was the validation of a survey instrument to be applied to a larger population within the airline training environment.

Review of Literature

Public Law 111-216

The present regional airline new hire pilot market is heavily impacted by Public Law 111-216 which mandated all first officers to have an Airline Transport Pilot certificate. Prior to this mandate, typical first officer hiring minimums would range from 600 – 1,000 total flight hours (Bjerke et al., 2016). Currently, the minimum hiring requirements for a first officer is 750 hours for pilots with military training, 1,000 hours for pilots with an aviation degree and 60 qualifying credits from an accredited university, and 1,250 hours for pilots with an aviation degree and 30 qualifying credits from an accredited university. This may seem like a small, incremental change, but it has had a significant impact on the availability of qualified regional airline pilot applicants as well as the training profile required for these new hire pilots.

It may seem that a more experienced new hire pilot would require less training before being ready to fill their role as a first officer at a regional airline. This was recently found to be a false assumption. Shane (2015) found that pilots who had 1,500 hours or more and were hired after the First Officer Qualification (FOQ) ruling required extra training events. In short, more experience does not necessarily mean more qualified.

Transitional Factors Between Higher Education and the Workplace

The transition from the undergraduate education into the working world has been studied extensively, but continues to change and evolve as education, receiving industry and – most importantly – those transitioning also change and evolve. This makes for the study of such topics a dynamic and somewhat inexact science. A related subtopic are the generational factors which are inherent to selected age-dependent populations, commonly referred to as Baby-Boomers, Gen- X, Gen-Y and Millennials. It should be noted that the observations witnessed by those who study these generational differences are general characteristics of the population, and not specific to one individual or another within that population.

As they are the most recent entrants into the labor market, recent publications have focused on the Millennial generation. This generation, as with all those listed above, has a certain subset of traits, both considered positive and potentially somewhat less so. In *Educating the Invincibles,* Benfer & Shanahan (2013) studied the factors which supported and detracted from the success of clinical law students as they prepare for the transition to the working world. Of the characteristics outlined by the authors, those which supported the transition and were considered to be positive aspects by their respective employers and/or educators included: high ambition, quick learners, strong desire for responsibility, and inclination to work collaboratively (2013). Conversely, those students also generally exhibited certain characteristics which challenged the transitioning employee and employer's expectations regarding workplace professionalism and performance. The listed factors included high pressure to perform, concerns about making mistakes, perception of self-entitlement and narcissistic tendencies (2013).

As the authors conducted their research in a professional field (clinical law), certain parallels can be observed when comparing against the transitioning undergraduate student with pilot training and certifications into the professional pilot career path. Some of these characteristics include a *driven, focused employee population.* Professional piloting and clinical law practice both require a certain level of precision, motivation and attention to detail when compared with other disciplines, although many other disciplines also exhibit similar employee attributes/requirements.

In addition to generational factors, there are also cultural and discipline- related factors which affect the transition process of the student to the professional. A 2008 study focused on political science students, as separate populations, in Sweden and Poland. The researchers identified, through a specific interview method, key factors which influenced the Swedish and Polish students just before the entered the workforce and approximately one year after they were in their respective roles (assuming they were employed). Although the sample size was small (21 between both groups), they researchers did observe differences between Swedish and Polish students as they faced this transitional period. In addition to seeking the information on the preparedness of the students/employees, the authors explored selected subtopics such as cultural influences (between Sweden and Poland), and economic factors endemic to the country and region. Interestingly, the authors noted the following with respect to the two populations:

> Polish students face numerous challenges, possible unemployment, lack of accommodation, a very low standard of living and poor salaries. The small group of Swedish students usually face different kinds of challenges, which are not existential in nature. They are, instead, occupied by questions such as whether their future employment will be satisfactory, whether their knowledge base is sufficient or whether they will be able to use skills in their profession. The task of coping with an uncertain future presents itself to both groups but in different shapes. (Johansson, Kopciwicz, & Dahlgren, 2008, p. 229)

When we consider the issues identified by Johansson et al. (2008), we can see that the professional pilot career may have a blend of the issues faced by the populations observed in the 2008 study. Although salaries have recently improved for the new hire pilot through bonuses and other incentives, based on experience and anecdotal evidence the first-year wage was approximately $19,000 - $25,000 for the average regional airline crewmember. This created unique *existential* challenges similar to those witnessed by the Polish students in the 2008 study. At the same token, many new hire pilots are entering a field for which they have read about, studied, or discussed with mentors, but which they have not themselves experienced. In addition to the question of whether their previous undergraduate training will be adequate to prepare them for success in the professional pilot world, they also face personal stresses. Some of these personal stresses include significant absences from any home location, concerns over economic stability of the airline, company mergers or acquisitions, and potential changes to base location, aircraft, and ability to upgrade to a captain position.

Many of the factors listed above have been studied extensively, including one recent Portuguese study. Researchers Monteiro, Santos and Goncalves embarked upon a multi-year project to develop an assessment tool to determine factors which influence students as they transition from higher education and into the workplace. At the time of this publication, the assessment tool was a culmination of three iterations of mixed-methods research, finally resulting in what is known as the *Scale of the Meanings of Transition from Higher Education to Work, or SMTHEW.* (Monteiro, Santos, & Goncalves, 2015) The authors' position is that there are a multitude of factors which face students as they prepare to make the leap from the protected area of higher education into the unknown realm of the workplace, however, there was not yet a tool which effectively measured the impact of these factors in a meaningful way.

Although not an exhaustive list, some of the issues students face when approaching the point of transition were job market saturation, economic instability, temporary employment, emigration, personal and family pressures, and the desire for personal fulfillment and responsibility in the workplace. Through the course of the research, the authors systematically identified the key factors, starting with all respondents' feedback, and eventually determining four separate fields which seemed to form a construct around the issue of transition from higher education to work. The four principle factors, determined through statistical analysis, include Uncertainty, Responsibility, Personal Fulfillment, and Unemployment (Monteiro et al, 2015).

Acknowledging the "Halo Effect" on New Hire Ratings

There have been challenges with objective assessment of employee performance as long as there have been managers or trainers to observe and employees to assess. One of the primary, if not *the main* challenge is are the limitations associated with the human observer, or rater. One of these issues relates to the inability of the rater to separate aspects of the individual's nature and achievements (their global evaluation) and rate each individual aspect independently (Thorndike, 1920). Interestingly and apropos to this study, Thorndike's (1920) work evaluated the assessments of aviation cadets, however, in different areas including Physical Qualities, Intelligence, Leadership and Personal Qualities (or Character). The term coined by Thorndike is "generally defined as the influence of a global evaluation on evaluations of individual attributes of a person." (Nisbett & Wilson, 1977, p.250). This effect has been studied in a variety of disciplines including student nurses (Brown, 1968), student evaluations of an instructor with a British accent (Nisbett & Wilson, 1977), and clerical workers from a petrochemical company (Nathan & Tippins, 1990) amongst others. All of these tend to concur with Thorndike's original work. Mitigating the impact of the "halo effect" can be accomplished in one of several ways, primary being through statistical methods or through advanced training of the raters, called *inter-rater reliability*.

One unique proposal suggested that the *halo effect* is not actually a negative attribute at all, but recognizes the assessment of the individual as a whole, versus specific attributes. In fact there is suggestion that the *halo effect* actually improves the rater's accuracy. "Laboratory investigations using videotaped target rates consistently show that halo and rating accuracy are positively related." (Nathan & Tippins, 1990, p. 294) As it relates to this study, respondents were not provided specific training on how to answer the survey questions, however, are exposed to a form of *inter-rater reliability* training during their annual instructor standardization meetings in the course of compliance with the requirements of the airline's Advanced Qualification Program (AQP) data collection requirements. Thus, some prior knowledge of evaluation and standard assessment can be assumed. One consideration which is a modification to the general requirements of the *halo effect* is that the respondents of the present study (raters) reported aggregate performance of their experiences with a specific subset of the new hire pilot group, versus observations of individual pilots. That recognized, individual raters may have strong impressions (both positive and negative) which may have influenced their overall ratings of the group. In some respects, a form of the *halo effect* is still present and applicable in this study. Future research should account for the influence of this statistical error.

The Generation Gap and Motivation

It is also possible that the generational differences between those providing the new hire training and those receiving the new hire training have a profound impact on the perceptions of motivation. The phrase, "…this new generation just does not seem to show any motivation…" is commonly heard in many disciplines. Is it true that the current generation is not motivated or is it true that the current generation is motivated differently than previous generations? The answer may be somewhere in the middle, but it is clear that different generations are motivated differently, often as a product of their up-bringing. The present research used survey data from the instructors who provide training to new hire pilots at a regional airline and as such, is a measurement of the perceptions of new hire performance and motivation. It is likely that the survey data includes many of the pre-existing biases that come with generational differences (Twenge, 2009).

There are many variables to consider when ascertaining motivation of new hires as they progress from the post-secondary school environment into the workforce. There are a few theoretical frameworks that have been developed to understand motivation of students which can be applied to new hire pilots. To inform this research, we considered two theoretical constructs that have been found empirically sound; self-determination theory and achievement goal theory specifically relate to the current pilot study. Each of these frameworks will be discussed below in an attempt to identify applicable variables, as well as appropriate and established measures.

Motivation

Self-Determination Theory

Ryan and Deci (2000) proposed a theoretical framework in which both internal and external factors should be considered in making assessments and predictions about motivation. It is proposed that there are three categories of motivations on a continuum between a self-determined student and a non-self-determined student. The location of a student along this continuum of self-determination has an impact on student motivation and potentially student performance and course completion. Guay, Ratelle, Roy, Litalien, (2010) proved a conceptual model that academic self-concept, facilitates autonomous academic motivation, which in turn facilitated achievement. In short, students who first had specific or global self-concept (belief about one's academic performance) had more autonomous academic motivation, which yielded higher academic achievement (Guay, Marsh, et al., 2003). This conceptual model could explain a causal factor for the variance in new hire motivation. A new hire who graduates from an accredited aviation program is likely to have a higher subject specific self-concept than a new hire who has not received specific training in the various facets of airline operations prior to his or her employment. Based on this assumption, it is possible that new hire self-concept increases as students' progress through the program, leading to an increase in autonomous academic motivation and a higher overall achievement as the new hire progresses through the training program. Conversely, a new hire who feels overwhelmed by learning the new topics being presented may be less successful in achieving the requirements of the training program.

The present study used two survey questions to measure the difference in perceived technical knowledge and professionalism of new hire pilots at a regional airline. Respondents were provided a list of the AABI accredited aviation schools and were asked to indicate the level of technical proficiency and professionalism difference between new hire pilots who graduated from AABI accredited aviation schools compared with new hire pilots who did not graduate from AABI accredited aviation schools.

Change/Stability of Achievement Goals

Elliot and McGregor (2001) proposed and tested a 2 x 2 achievement goal framework. This framework broke student achievement into four possible groups, mastery-approach, mastery- avoidance, performance-approach, and performance-avoidance providing further explanation for varying student motivation and academic achievement. Fryer and Elliot (2007) went further to determine change/stability of achievement goals over time. This research included three longitudinal studies in which achievement goals were assessed one week prior to course examinations. The results of each of these longitudinal studies found a significant decrease in mastery-approach goals after the first examination and before the second examination. Performance-avoidance goals showed a significant increase between the first and second examinations. None of the other goals showed any significant change throughout the study. It is possible that an individual's first encounter with a task or subject will have a significant influence on goal change (Fryer and Elliot, 2007). With this in mind, it is possible to surmise that new hires without a degree from an accredited aviation program may experience significant goal and motivation changes as a result of their first encounter with the airline training program. It is possible that the experience of a new hire with little knowledge of airline procedures shift their achievement goal orientation and cause a significant decrease in student motivation after or during the initial training at a regional airline.

Method

Participants

Participants used in this research were 49 employees in a management or instructor role at a regional airline training department located in the United States. These respondents provided their individual perceptions regarding their observations and experiences working with or providing initial qualification instruction to new hire pilots. Participants were excluded under 3 conditions: Not involved in the training of new hire pilots (*n* = 0), haven't been involved in the training of new hire pilots within the last year (*n* = 5) or if they did not answer the question that asked for their role (*n* = 6). The remaining participants fell into 5 categories: ground instructor *n* = 3), simulator or flight training device (FTD) instructor (*n* = 11), Aircrew Program Designee (APD) (*n* = 6), operating experience (OE) line check airman (*n* = 13), management/supervisory personnel (*n* = 7). The final sample consisted of 37 participants. Refer to Table A1 in the Appendix for a table of the descriptive statistics of the participants.

The participants in this study provided generalizable perceptions of new hires entering the regional airline industry within the United States. The data gathered in this survey is expected to represent the perceptions of management and instructors of new hires during the initial qualification process at other regional airlines.

Measures

Research in the area of perceived technical knowledge and professionalism of new hire pilots is new and as a result, very few scales exist that applied directly to this research. Existing scales focus on self-perceptions of technical knowledge and professionalism. For this reason, new measurement scales were devised to measure the constructs of perceived knowledge and professionalism. The exploratory nature of this research make the development and proving of new measures for perceived pilot knowledge and professionalism appropriate. Perceived technical knowledge of new hires was measured by one scale which contained eight items measured on a 5-point Likert-style scale (*1 = Not well prepared; 5 = Very well prepared*). All seven items were positively-worded, (*Please rate your general observations of new hire pilot knowledge of instrument procedures)*. A high score correlated to a high level of perceived technical knowledge. Refer to Table A2 in the Appendix for a table of descriptives relating to these questions.

Perceived professionalism of new hire pilots was measured by one scale which contained six items measured on a 5-point Likert-style scale (*1 = Not well prepared; 5 = Very* *well prepared*). All six items were positively-worded, (*Please rate your general observations of new hire pilots arriving on-time for classroom training and briefings).* A high score correlated to a high level of perceived professionalism.

Procedure

The survey instrument was administered using Qualtrics online survey software. The survey was sent to participants at a regional airline located in the United States and participants were solicited by an email requesting voluntary responses. Each participant confirmed a willingness to participate by reading an informed consent form which appeared at the beginning of the survey before the measurements were administered and making a declaration of willingness to proceed with the survey. The survey was open for one month at which time the survey was closed and data was collected. The survey took about 8 minutes to complete.

Analysis

Distributions of responses were normal for the perceived technical with the exception of one item. This item asked the participant to "*Rate your perception of the new hire pilot's knowledge of abnormal and emergency operations."* This item was positively skewed slightly outside of normal limits (skewness: 1.54). This highlighted a possible area of weakness with new hire pilot's knowledge of abnormal and emergency operations as it indicates that a large portion of participants rated new hire pilot's knowledge of abnormal and emergency items as below average. This is a somewhat expected result, given the low exposure to abnormal and emergency situations. It is also possible that this skewness is a result of the educator bias mentioned above, further research is needed to gain deeper insight. Distributions of responses were normal for the perceived professionalism items.

To test for construct validity an exploratory factor analysis (EFA) was conducted that included all items relating to technical knowledge and professionalism using direct oblimin rotation. Results yielded three factors with eigenvalues greater than 1.0, but the scree plot suggested a two-factor solution. These factors aligned properly with the hypothesized scales, one based on perceived technical knowledge of the new hire, and one based on the perceived professionalism of the new hire.

The perceived technical knowledge measurement was determined reliable by a high Cronbach's Alpha ($\alpha = .87$). The perceived professionalism measurement was also determined reliable by an equally high Cronbach's Alpha ($\alpha = .91$). Each of the scales were then averaged into a new variable to determine appropriateness of the distributions given the larger constructs that were being measured. The new variable that represented new hire technical knowledge was normally distributed (skewness = .40; kurtosis = .16). The new variable that represented new hire professionalism was normally distributed (skewness = .90; kurtosis = .95).

For the purposes of exploring meaningful correlation for future research, the researchers grouped respondents based on two main criteria; when (chronologically) the new hire pilot interacted with the respondent and (2) balancing groups to achieve roughly equal distributions between groups. The data was grouped into three "Phases" by role. Phase 1 group was comprised of respondents who were either management or supervisory role and ground instructors, Phase 2 was comprised of FTD/full motion simulator instructors and Aircrew Program Designees (APDs) or simulator check airmen. The final Phase was strictly maintained as the OE instructors or OE line check airmen. These "phases", as noted above, are roughly arranged in chronological order based on time of interaction in the initial qualification (IQ) training footprint, and as a secondary benefit of this combination was to produce roughly equal groupings. As reported under descriptive statistics, Phase 1 had 11 respondents, Phase 2 had 17 respondents, and Phase 3 had 15 respondents.

Results and Discussion

The survey instrument used for this pilot study proves both valid and reliable. With respect to the preliminary results of this study, the researchers anticipate similar outcomes with a broader sample of the regional airline pilot training programs. Due to the exploratory nature of this pilot study, further investigation will be required to confirm findings included in this study.

The researchers noted several important points regarding the data, which will be beneficial for areas of future research. When viewing inter-item correlations, there were three strong positive correlations. These statistically significant correlations were (1) "Perceived knowledge of airline procedures and operations", (2) "Perceived communications with ATC", (3) "Perceived ability to use company manuals and procedures."

The data showed an increase in the means in perceived knowledge of from phase 2 to phase 3. This is an expected observation as new hire trainees are exposed to and practice airline procedures during the simulator training phase and subsequently apply those in the "live" operational experience environment.

The data showed a decrease in the means of perceived communications with Air Traffic Control (ATC) between Phases 1 and 2. This is an important point to consider as Phase 1 respondents may neither actively train, nor have an opportunity to effectively observe ATC communication abilities during the Phase 1 experience. This may lead to an inappropriate attribution of skills which may not have been observed in their entirety. Depending on the structure of the individual airline's training footprint and who may be performing that training, new hire trainees may not be afforded an opportunity to practice or demonstrate proficiency in standard ATC phraseology. Whereas, when trainees enter Phase 2 simulator training and checking, their ATC communication skills may be actively observed and critiqued. It is important to understand that this may be an area of improvement for many airlines who have a similar designed IQ training footprint.

In addition to examination of the factors associated with specific phases of training, the researchers also performed statistical test on the individual responses (variables) in relationship to each other. Although significance was noted in all variables to at least one other response, it is important to consider both the significance and actual correlation coefficient values. While some coefficients were found to be significant, the correlation value only indicated a weak or weak to moderate relationship.

One of the perceptions which showed both the strongest and the greatest number of correlations to other responses was new hire *General Ability to Use Company Manuals and Procedures.* This data point showed moderate positive correlations with 11 other variables. The next variable with positive correlations was: *Arriving with the appropriate dress for the training event or flight.* This metric showed a positive correlation with 12 other variables. *General knowledge of aircraft systems* showed positive correlation to 11 other variables, with nine also being statistically significant. Showing similar significance to perceptions on manual usage was *Ability to receive and act appropriately on feedback from an instructor or examiner.* This metric showed moderate positive correlations to ten of the other variables. *Knowledge of abnormal and emergency operations* showed statistical significance to eight other variables. Finally, the last variable with strong relationship to other variables was *Ability to show a positive attitude in the training environment.* This metric has a statistically significant relationship to ten other responses. Each of the correlations discussed above show statistical significance to the $p<0.05$ level.

Implications for Future Research

All of the responses and correlations discussed point to a larger picture on motivation and engagement of the new hire candidate. It is no surprise that a motivated new employee is going transition more successfully into the working world. During this transition this motivated and engaged employee would be ostensibly expected to perform better and be perceived as such by mentors/instructors than someone who does not have the same level of motivation and engagement. However, other considerations were noted during this research relating to instructor attitudes and influence on data collection, initial qualification footprint structure, and areas for additional focus during initial qualification.

Examining selected data points within the role and phase of training, certain patterns appeared which suggested that instructors' attitudes and expectations on trainees change as the phase of training changes. Additional research is needed to determine if or how these instructors' attitudes are impacting data collection (e.g. AQP data collection) as well as the long-term modifications and improvements to the training footprint which arise from analysis of collected data. Additionally, the structure of the training footprint itself may impact instructor perceptions on new hires, collected data, and how future footprint modifications could occur.

Though the survey instrument was found to be reliable and valid, certain demographic data was absent including age of the respondent (instructor/manager), years of service with the company, years of service in position, seat position (Captain or First Officer), years of experience instructing in Part 121. The addition of more demographic information in the revised survey instrument will allow for better categorical grouping and account for confounding variables. In the present exploratory research, many factors may influence the perception and ultimate response by the participant when measuring technical and professional readiness.

Limitations

This research was conducted using a convenient sampling of participants from one regional airline in the United States. This yielded a limited sample of participants and in some cases, meaningful correlations needed a larger sampling. Additionally, this research only included the perceptions of instructors and did not include new hire perceptions of their own performance or factors related to motivation. Of these observations, the individual respondents were reporting aggregate experiences, versus individualized data on specific new hire pilots.

Conclusions

The researchers note relationships among key variables which could highlight areas for additional focus and scrutiny in the airline ground training footprints and preparation of incoming new hire pilot candidates in advance of initial hire. Responses which showed strong significance to other variables were distributed between both technical and professional preparation, which could suggest a separate, but related relationship between those general characteristics of a new hire candidate. The strongest responses also seem to paint a clear picture for what a successful candidate should focus on during their preparation in advance of and during initial training.

To illustrate this point, a new hire who appears to demonstrate competent knowledge on use of airline manuals and procedures is also likely to demonstrate a stronger understanding of aircraft systems as well as be able to apply that systems knowledge and aircraft manual familiarity effectively during training of abnormal and emergencies. From the professionalism perspective, a new hire who arrives in the training environment dressed appropriately is going to receive some benefit of the “halo effect” (Thorndike, 1920) by subsequent instructors with whom he/she comes into contact. This may create the perception that the pilot is showing a positive attitude in the training environment by respecting the professional appearance expectations of the career and also that he or she responds appropriately to feedback from the instructor or examiner, simply from the formal appearance and the respect which is carried by it.

An appropriate outcome of this foundational research is to create a picture of the factors which point to a successful outcome for a new hire as perceived by their respective instructor/evaluator. Through this effort, the researchers have found the survey instrument both valid and reliable. To continue refining the instrument for further data collection, the researchers determined additional response areas which will serve to enhance the survey instrument and illustrate a more complete representation of the interaction between student/instructor. Areas which the researchers will add to the subsequent iteration of the survey instrument include the following: age of the respondent, years of service with the company, years of service in position, seat position, years of experience instructing in Part 121. These data points will assist the researchers and partner companies, in two areas: (1) evaluating their reported data through the perspective of their instructor cadre, and (2) proper training and coaching of both new and experienced instructors to ensure collected data is valid, reliable, and useful towards continuous improvement of the training system.

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Appendix

Table A1

Descriptive Statistics of Participants

Measures	*n*	%
Participant's Role		
Management	4	10.8
Ground Instructor	3	8.1
Simulator Instructor	11	29.7
APD or Sim Check Airman	6	16.2
OE Line Check Airman	13	35.1

Table A2

Descriptives of Survey Questions

Measure	Number of items	Anchors	N	α	*M*	*SD*	Actual range
Technical Knowledge*	7	1 = *Not well prepared* 5 = *Very well prepared*	35	.87	4.00	.52	2.86-5.29
Professionalism*	6	1 = *Not well prepared* 5 = *Very well prepared*	27	.91	4.27	.62	3.33-6.00

* As perceived by research participant.

Table A3

Correlations of Perceived New Hire Preparedness

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Instrument Knowledge	-															
2. Airline Procedures Knowledge	.43**	-														
3. Communications Knowledge	.43*	.61**	-													
4. Aircraft Systems Knowledge	.47**	.46**	.43**	-												
5. Limitations Knowledge	.37*	.35*	.53**	.79**	-											
6. Emer. Procedures Knowledge	.36*	.44**	.54**	.56**	.66**	-										
7. Manual Usage	.56*	.51*	.63**	.51**	.56**	.59**	-									
8. On Time	.04	.15	.19	.34*	.35*	.40*	.33	-								
9. Preparation	.33	.41*	.20	.51**	.38*	.38*	.46**	.52**	-							
10. Appropriate Dress	.38*	.47**	.34*	.56**	.46**	.46**	.46**	.40*	.66**	-						
11. Positive Attitude	.44**	.19	.32	.38*	.36*	.45**	.45**	.49**	.65**	.63**	-					
12. Response to Critique	.50*	.23	.27	.41**	.45**	.36*	.52**	.45**	.69**	.54**	.70*	-				
13. Crew Resource Management	.33	.13	.33	.28	.28	.44**	.40*	.49**	.57**	.62**	.56**	.70**	-			
14. Comparative Knowledge	.11	-.14	.08	-.07	.06	-.06	.25	.40*	.17	-.09	-.12	.22	.11	-		
15. Comparative Professionalism	.13	.05	.05	-.20	-.05	-.06	.13	.06	.12	.16	.16	.36	.27	.68**	-	
16. Phase of Training	-.01	.02	-.21	-.09	-.23	-.01	.07	.02	.24	-.06	.11	.04	-.03	-.37*	-.20	-

* Indicates significance at the 0.05 level
** Indicates significance at the 0.01 level
*** Indicates significance at the 0.001 level

Industry and University Alignment

Survey Instrument [Consent

Statement – Removed]

- ❍ I have read the informed consent statement and AGREE TO PARTICIPATE.
- ❍ I PREFER NOT TO PARTICIPATE at this time.

Do you currently work in a role training, evaluating, OR overseeing the training and evaluation of pilots or pilot candidates (trainees)?

- ❍ Yes
- ❍ No

What is your role within the training process of new-hire [Company] pilots? (If you are in more than one role, select the option in which you spend MOST of your time).

- ❍ Ground Instructor
- ❍ Full Motion Simulator or FTD Instructor
- ❍ Aircrew Program Designee (APD) or Sim Check Airman
- ❍ OE Line Check Airman
- ❍ Management or supervisory
- ❍ Other, please specify ____________________

Within the last year, have you provided training in a classroom, Flight Training Device (FTD), full motion flight simulator, or physical aircraft to any pilot or pilot-trainee seeking additional certificates or ratings at [Company]?

- ❍ Yes
- ❍ No

Please rate your general observations on the following areas of TECHNICAL KNOWLEDGE of new-hire [Company] pilots? (Please rate your overall observations, it is understood that individual differences exist).

	No Observation (Not applicable)	Not well prepared	Below average	Average	Above average	Very well prepared
Knowledge of instrument procedures.	☐	☐	☐	☐	☐	☐
Knowledge of airline procedures and operations	☐	☐	☐	☐	☐	☐
Communications with ATC	☐	☐	☐	☐	☐	☐
General knowledge of aircraft systems	☐	☐	☐	☐	☐	☐
General knowledge of aircraft limitations	☐	☐	☐	☐	☐	☐
Knowledge of abnormals and emergency operations	☐	☐	☐	☐	☐	☐
General ability to use company manuals and procedures	☐	☐	☐	☐	☐	☐
Other - Please comment	☐	☐	☐	☐	☐	☐

Please provide any additional commentary regarding new-hire pilot TECHNICAL KNOWLEDGE. (This response applies to all interactions with 'new-hire' pilots with whom you've interacted).

Please rate your general observations on the following areas of PROFESSIONALISM of new- hire [Company] pilots? (Please rate your overall observations, it is understood that individual differences exist).

	No Observation (Not applicable)	Not well prepared	Below average	Average	Above Average	Very well prepared
Arriving on-time for classroom training and briefings	☐	☐	☐	☐	☐	☐
Arriving well-prepared for classroom training and briefings.	☐	☐	☐	☐	☐	☐
Arriving with appropriate dress for the training event or flight.	☐	☐	☐	☐	☐	☐
Ability to show a positive attitude in the training environment.	☐	☐	☐	☐	☐	☐
Ability to receive and act appropriately on feedback from an instructor or examiner.	☐	☐	☐	☐	☐	☐
Ability to work effectively as a crew (demonstrate CRM skills).	☐	☐	☐	☐	☐	☐
Other please note	☐	☐	☐	☐	☐	☐

Please provide any additional commentary regarding new-hire pilot PROFESSIONALISM. (This response applies to all interactions with 'new-hire' pilots with whom you've interacted).

[Company] trains pilots from a multitude of backgrounds and experiences. With respect to your SPECIFIC experiences working with new-hire pilots who were trained at four-year undergraduate institutions accredited by or affiliated with the Aviation Accreditation Board International (AABI), how would you rate their TECHNICAL KNOWLEDGE against peers whom did not attend such institutions? Note: Examples of AABI accredited or affiliated institutions include: South Dakota State University, University of North Dakota, Mankato State University, Bridgewater State, Kansas State, Kent State, Oklahoma State, SE Oklahoma State University, University of Oklahoma, Western Michigan, University of Nebraska - Omaha, Southern Illinois University, Purdue University, Louisiana Tech University, Middle Tennessee State University, Auburn University, Arizona State University

- Much Lower
- Slightly Lower
- About the Same
- Higher
- Much Higher
- No basis for judgment

[Company] trains pilots from a multitude of backgrounds and experiences. With respect to your SPECIFIC experiences working with new-hire pilots who were trained at four-year undergraduate institutions accredited by or affiliated with the Aviation Accreditation Board International (AABI), how would you rate their PROFESSIONAL PREPAREDNESS against peers whom did not attend such institutions? Note: Examples of AABI accredited or affiliated institutions include: South Dakota State University, University of North Dakota, Mankato State University, Bridgewater State, Kansas State, Kent State, Oklahoma State, SE Oklahoma State University, University of Oklahoma, Western Michigan, University of Nebraska - Omaha, Southern Illinois University, Purdue University, Louisiana Tech University, Middle Tennessee State University, Auburn University, Arizona State University

- Much Lower
- Slightly Lower
- About the Same
- Higher
- Much Higher
- No basis for judgment

Please provide any other comments you believe would be appropriate to include in this survey response.

STUDY 2

ASSESSING MOTIVATION AS PREDICTORS OF ACADEMIC SUCCESS IN COLLEGIATE AVIATION CLASSROOMS

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Abstract

The aviation industry changes rapidly, as such it is important to continually re-assess our understanding of future aviation professionals and how their motivation translates into career-related performance. The present study applies *Social Cognitive Theory* (Bandura, 1986) to understand 229 students' motivation in a fourth-year technical aircraft systems course. To further our understanding of motivation and performance, the Science Motivation Questionnaire II (Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011), which measures intrinsic motivation, career motivation, grade motivation, self-determination and self-efficacy, was adapted to the collegiate aviation domain. Using structural equation modeling techniques (Arbuckle, 2017), the study found strong predictive relationships between self-efficacy and academic performance, as well as a moderate relationship between self-determination and academic performance. The study found weak or unanticipated results as to the regression relationship between academic performance and grade motivation, intrinsic motivation and career motivation. This study reinforces concepts on motivation and academic performance within the environment of collegiate aviation.

Keywords: motivation, learning, aviation, college, SEM

Assessing Motivation as Predictors of Academic Success in Collegiate Aviation Classrooms

During the time of this study (2018-2019), a significant pilot shortage existed and was forecasted to worsen (Klapper & Ruff-Stahl, 2019; Meredith, 2019). Pilot candidates were offered generous incentives such as hiring bonuses, guaranteed interviews at major carriers, and other lucrative perquisites (Lutte & Lovelace, 2016; Regional Airline Association, 2019; Samost, 2018). The external rewards and the incentive to enter the industry were arguably strong for future aviation professional, each interested in securing a coveted seniority number at a select airline or commercial aviation operator. These conditions provided unique context in which to study motivation within the pre-career collegiate aviation student. What remains to be seen is the influence of the various motivational subtypes on pre-career collegiate aviation students' academic success. How much does career motivation matter? Are the students intrinsically motivated to perform? Are there other motivational theories which appear to influence academic performance of pre-career aviation students?

In the present study, we examined the relationships of a set of motivation constructs (Intrinsic Motivation, Career Motivation, Self-Determination, Self-Efficacy, and Grade Motivation) with senior-level aviation students' academic outcome represented as an average exam score in a technical systems course. Participants were pre-career aviators studying aircraft types that they will likely fly in their future career path. Additionally, as a matter of enrollment in the course, the students were using aircraft systems courseware employed by many regional and mainline air carriers in the United States. This timing is critical as they are seeing a small window into their potential career paths; thus, the study is undertaken during a transitional point in their lives to evaluate students' motivations and academic achievement. To begin, we will provide a brief overview of changes in the airline industry, discuss relevant motivational theory, and finish with relevant research into motivation.

Changes in the Aviation Industry

Industry conditions present during the decade prior to this study allow us to understand issues relevant to the pre-career aviation professional's decision to enter the field. As has been well documented by research and media reports, a pilot shortage was quickly developing and was forecasted to increase (Higgins et al. 2013; Lutte & Lovelace, 2016, Meredith, 2019). At the time of the data collection, the Boeing Pilot & Technician Outlook (2019) indicated 804,000 new civil aviation pilots would be needed globally over the next 20 years. As such, significant market demand for new pilots and growth for demand in air travel has placed a significant pressure on the supply of commercial pilots. Sources of qualified pilots, such as current certified flight instructors (CFIs) at collegiate aviation institutions, are prime candidates for recruiters from regional airlines, major airlines, cargo, corporate, and military recruiters. This favorable recruitment environment may have impacted pre-career aviators' expectations and motivations towards their chosen career. Offering theoretical perspective into this research, relevant motivational theories and concepts are describe below.

Motivational Theory

Many motivational theories offer diverse perspectives on how to interpret individual motivation within a particular environment. Glynn et al. (2011) utilized motivational theories from multiple sources to inform and interpret the SMQ-II. One such motivation theory is Bandura's (1986) Social Cognitive Theory (SCT). Additionally, other prominent theories, such as Self-Determination Theory (SDT; Ryan & Deci, 2000a; Black & Deci, 2000) inform interpretation of other latent constructs within the SMQ-II. Individual motivational constructs included in the SMQ-II are explained here.

Self-Efficacy

In this study, Bandura's tripartite model was represented through the personal factor as *self*-efficacy¸ or the belief in one's ability to perform or achieve. In the research by Glynn et al. (2009), low self-efficacy was shown to be related to assessment anxiety. The results suggest that high self-efficacy would lead to low grade anxiety and an expectation of success as a result of one's confidence in their abilities. Within the aviation career path, an individual's confidence in their abilities may continue to rise as they progress through repeated tests and performance validations. Students who do not pass high pressure exams or flight checks may self-select out of such programs and may not be reflected in this dataset.

Intrinsic Motivation

Intrinsic motivation, or the enjoyment or interest in a particular subject, arises from the work of Ryan and Deci (2000) within SDT. Intrinsic motivation has been found to be a predictor of airline career choice (Daku & Stupnisky, 2017) as well as number of hours spent to complete flight lessons (Forsman, 2012). In the current study, students may demonstrate intrinsic interest in the study of aircraft systems due to their complexity, innovation or design. Alternatively, students in the sample may find the subject matter boring or dry and may not be intrinsically motivated to study the material.

Self-Determination

Self-determination is referenced by Black and Deci (2000) as motivated behaviors, "which vary in the degree to which they are as autonomous versus controlled" (p.741). Ryan and Deci (2000b) describe self-determination as being used interchangeably with autonomy. In the context of learning science, self-determination was also cited as *responsibility* for an outcome by Glynn et al. (2009). In the present study, self-determination is characterized by the individual choices and actions (autonomy) an aviation student exerts towards the study of aircraft systems.

Career Motivation

Career motivation is referenced as a form of long-term *extrinsic motivation* as cited by Glynn et al. (2011). Extrinsic motivation is defined as “the performance of an activity in order to attain some separable outcome” (Ryan & Deci, 2000a, p. 71). A collegiate aviation student’s career motivation could include opportunity for competitive salary or prestige associated with the commercial aviation career path. Individual items within the career motivation latent variable are most closely aligned with what Ryan and Deci (2000a) label *identified* motivation, or “a conscious valuing of a behavioral goal or regulation” (p.72). As such, the career motivation variable could be informed by both SDT as an extrinsic *identified* motivator as well as by SCT (Bandura, 1986) as an environmental factor.

Grade Motivation

Grade motivation is another form of extrinsic motivation, but with a short-term view of external rewards (Glynn et al., 2011). A collegiate aviation student in the study may consider a high exam or course grade a positive outcome, or reward, for their efforts in class. Grade motivation does not specifically have a formal theoretical underpinning yet may be informed both by SDT (Ryan & Deci , 2000a) or by SCT (Bandura, 1986).

For aviation students included in this study, it is important to consider multiple variations of motivation and how the temporal and contextual environment may influence such motivation. A review of motivation and the airline career path follows.

Research on Motivation and the Airline Career Path

Research on the motivation of pre-career aviation professionals is in early phases of development and limited research exists among this unique population. One example of such motivation relates to motivation and career path interest (Daku & Stupnisky, 2017). In that study, the authors invoked Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000) to understand intrinsic, extrinsic and amotivation as they relate to the pilot graduate's choice of regional career post-graduation. The results indicated that students who exhibit higher *identified* motivation may be more likely to choose an airline by hourly pay and crew base. Additionally, the research revealed collegiate aviation students who report higher *intrinsic motivation* may choose an airline based on the referral of a friend or peer already working at the airline. Finally, important differences were observed in how students with different motivational attributes (such as *identified*, *intrinsic*, or *amotivated*) select their regional carriers for employment consideration. The current study sought to expand this developing area of research into the relationship of sub-types of motivation and how pre-career aviation students perform academically.

The purpose of the study is to evaluate reliability and validity of the SMQ-II (Glynn et al., 2011) within the collegiate aviation environment using exploratory and confirmatory factor analysis. The second purpose of this research is to employ structural equation modeling (SEM) to determine which latent construct of the SMQ-II best predicts academic success in a senior-level advanced aircraft systems course. The motivational subscales include intrinsic motivation, career motivation, self-determination, self-efficacy and grade motivation. The analysis of the research will be evaluated through the lens of SCT (Bandura, 1986).

Method

Participants and Procedure

This study was conducted within a senior-level advanced aircraft systems course offered at a university in midwestern United States. Of the 272 students enrolled in the advanced aircraft systems course, 84.2% (*N* = 229) participated in the study and completed the course (students who withdrew from the course before the end of the session were not included in the data analysis). The mean age of the participants was 22.1 (*SD* = 3.0), female students represented 12.7% (*n* = 29) of the respondents in the dataset. The students reported their racial identity as White (83.8%), Asian (7.9%), more than one race (2.6%), Black or African American (0.4%), Native Hawaiian or Pacific Islander (0.4%), or not reported (4.8%). As the course was for senior-level students, most participants reported senior status (82.1%) and the remaining were junior (17.0%) or sophomore (0.9%). The mean self-reported GPA was 3.45 on a 4.0 scale. Participants reported the expected grade to receive in the course as an "A" (52.1%), "B" (39.7%), or "C" (7.0%). At the time of the study, 70.8% of the students reported they were enrolled in a defined airline career pathway program or intended to be enrolled, whereas 29.3% reported not enrolled.

The survey instrument adapted to the "aircraft systems" subject matter was disseminated via the Qualtrics online survey tool. The survey research was conducted in Fall 2018, Spring 2019, Summer 2019, and Fall 2019 academic semesters. The research was approved through the institutional IRB and participants provided consent through the survey response.

Measures

The survey instrument was adapted from the Science Motivation Questionnaire II (SMQ-II), previously validated by Glynn et al. (2011). The survey instrument was selected as it included a diverse set of motivational subscales which were thought to allow for observation of differences in the studied population. The original five subscales from the SMQ-II were included in the survey instrument including *Intrinsic Motivation, Career Motivation, Self-Determination, Self-Efficacy,* and *Grade Motivation.* Individual survey items that included the word "science" were replaced with "aviation" to provide the participants a specific context in which to base their responses. There were five items for each subscale, and each response was provided on a five-point Likert scale (1 = *Strongly Disagree*, …, 5 = *Strongly Agree*). Example items for the subscales were as follows: *Intrinsic Motivation,* "Learning aircraft systems is interesting; *Career Motivation*, "Learning aircraft systems will help me get a good job"; *Self-Determination*, "I study hard to learn aircraft systems"; *Self-Efficacy*, "I am confident I will do well on aircraft systems tests"; *Grade Motivation*, "It is important that I get an A in aircraft systems" (full survey item wording is listed in Appendix, Table A1).

Student academic outcome (achievement) was measured through an individual variable compiled from four individual block exam scores and a final exam score during the academic term. The students' exam scores were summed and divided by the total exam points available through block exams and the final exam to generate a composite exam score variable.

Rationale for Analysis

The survey data was compiled with a composite average exam score for each student. Missing data was limited to nine individual unique items within the SMQ-II scale and was addressed by using similar response pattern matching (SRPM) technique outlined in Byrne (2016). SRPM was selected as it allows for bootstrapping and computation of additional model fit statistics, compared to other methods of handing missing data. Structural equation modeling (SEM) was accomplished using AMOS version 27 (Arbuckle, 2017). During the confirmatory factor analysis (CFA) process, measures of model fit were compared to recommended metrics.

Recommendations from for model fit include RMSEA <.06 = great, <.08 good, <.10 marginal; CFI > 0.90, >0.95 advised; TLI > 0.90 ok, >=0.95 good fit (Hu & Bentler, 1995; Byrne 2016). Hu and Bentler (1995) suggest a good fitting model with SRMR <= 0.08, whereas Byrne (2016) suggests a stricter definition at SRMR <0.05.

Results

Although this study employed an established scale, the questionnaire was adapted to a new discipline and new demographic, as such an exploratory factor analysis (EFA) was performed on the dataset using the dimension reduction feature of SPSS. Initially, the EFA was performed using principal-axis factoring, direct oblimin rotation and solutions with eigenvalues >1.0. This analysis method suggested a five-factor solution. Subsequently, the EFA was re-analyzed with a five-factor solution identified and suppressing factor loadings <0.30. The results of the EFA are shown in Table 3. Each of the five motivational constructs from the established questionnaire were evaluated for reliability using SPSS (IBM, 2017). Each scale showed good internal reliability. Results of reliability analysis are shown in Table 1.

The EFA yielded reasonably expected factor loadings with limited cross-loading of selected items. For consistency with Glynn et. al. (2011), two individual survey items were retained on their original construct despite evidence to support movement to stronger loading construct. Next we performed a confirmatory factor analysis (CFA).

Goodness of fit indices suggested inadequate fit of the initial CFA model. To improve model fit, individual factor loadings suggested one observed item on each of the Intrinsic Motivation (IN4) and Grade Motivation (GM5) subscales be removed. Evaluation of modification indices (MIs >10) suggested inclusion of covariance paths between a selection of

Table 1

Factor Loadings, Mean, SD and Reliability (SMQ-II Adapted to Aviation)

	Factor				
Item	Career Motivation	Grade Motivation	Self-Efficacy	Intrinsic	Self-Determination
IN1				0.49	
IN2				0.51	
IN3	0.44			0.35	
IN4				0.58	
IN5				0.74	
CM1	0.59				
CM2	0.94				
CM3	0.70				
CM4	0.65				
CM5	0.70				
SD1					0.41
SD2					0.68
SD3					0.59
SD4					0.64
SD5					0.48
SE1			0.67		
SE2			0.83		
SE3			0.34	0.34	
SE4	0.41		0.37		
SE5			0.70		
GM1		0.55			
GM2		0.80			
GM3		0.82			
GM4		0.88			
GM5		0.41			
Mean	4.71	4.42	4.06	4.17	4.08
SD	0.51	0.63	0.69	0.63	0.59
α	0.88	0.86	0.84	0.82	0.81

Note. N = 229

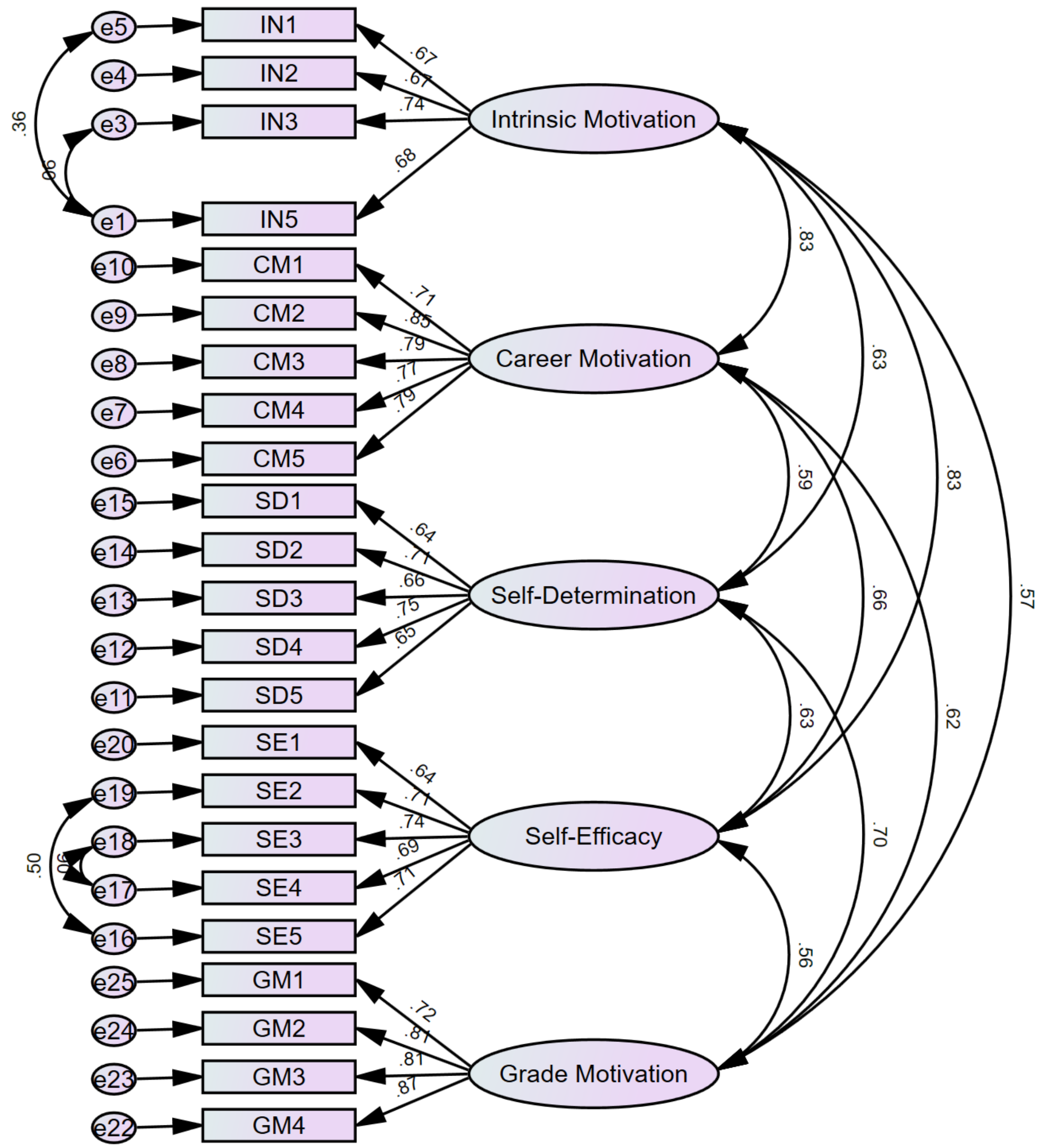
error terms within the same two latent constructs. On the intrinsic motivation latent construct, covariance paths were added between the error terms of IN1 and IN5 and between IN3 and IN5. On the self-efficacy latent construct, covariance paths were also added between two pairs of error terms; those being SE2 and SE5 as well as SE3 and SE4. Allowing error terms within the same construct to covary suggests variation in the individual error terms follows a similar pattern and may be related; subsequently, addition of covariance paths between related error terms improves model fit. After these model respecifications, the revised CFA model improved and was deemed sufficient for further analysis (see Figure 1).

Using the revised CFA model, analyses of convergent and discriminant validity were performed. Evidence of convergent validity was first evaluated by review of individual standardized factor loadings for strength and statistical significance. In the revised model, all individual standardized factor loadings were above 0.50 and most approached or exceeded 0.70, which is cited as preferable by Hair et al. (2014). Additional assessment of convergent validity is accomplished through review of average variance extracted (AVE) to examine which exceeded the 0.50 threshold (i.e., more than 50% of the scale variance explained by individual items). Average variance extracted were as follows: Intrinsic (0.48), Career Motivation (0.61), Self-Determination (0.47), Self-Efficacy (0.49), and Grade Motivation (0.65). This information suggests evidence of convergent validity for two of the five latent constructs and weak to moderate convergent validity for the remaining three.

To assess discriminant validity, that is if the latent variables are significantly unique or different from each other, the researchers compared the ‘average AVE’ between two constructs with the square of the bivariate correlation between the two constructs (Hair et al., 2014). If average AVE between the two latent constructs is greater than the square of the bivariate

Figure 1

Confirmatory Factor Analysis using SEM, Revised Model



Note. N = 229. Chi-square = 482.7, RMSEA = 0.074, CFI = 0.909, TLI = 0.893, SRMR = .061

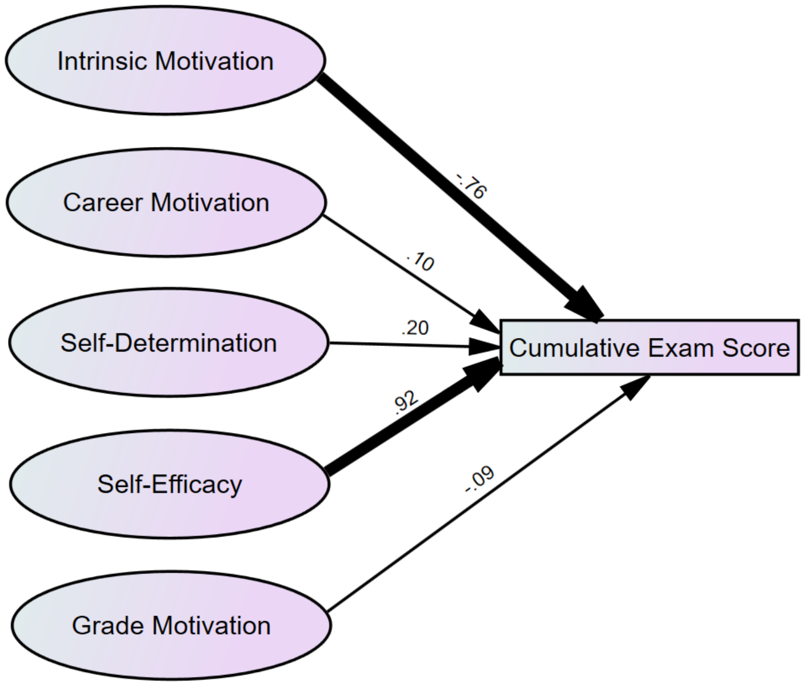
correlation, it suggests evidence for discriminant validity. Evidence of discriminant validity existed for all combinations of latent constructs except between intrinsic and career motivation as well as intrinsic and self-efficacy. The high degree of correlation between these two combinations of latent constructs suggests possibility for multicollinearity between the intrinsic motivation latent construct and two other latent constructs. Stated simply, students intrinsic motivation towards learning aircraft systems appeared to be highly correlated to their career motivation as well as their self-efficacy, or their belief in the ability to succeed.

After completing the CFA, a structural model was constructed in which the five motivation constructs predicted the endogenous variable cumulative exam score ((i.e., a fully saturated model, Figure 2). Goodness of fit indices remained consistent with the CFA previously performed, with little noted change. The student cumulative exam scores appeared to be strongly predicted by their self-efficacy. Somewhat paradoxically, intrinsic motivation was negatively predictive of their averaged exam score, although both statistical and contextual explanations for this result may exist. Weak predicative relationships are noted between self-determination, career motivation, and grade motivation and the students' academic outcome (cumulative exam score).

To compare the fully saturated model with existing theory, a competing structural model was created. Based on self-determination theory, the model was generated using two latent constructs as exogenous variables (self-determination, self-efficacy which are similar to the basic psychological needs of autonomy and competence) with paths to endogenous latent variables of intrinsic motivation, career motivation, and grade motivation, which in turn predicted academic outcome (cumulative exam score). Additionally, evaluation of modification indices (MIs) suggested inclusion of covariance paths between selected error terms from three latent

Figure 2

Motivation Construct SEM and Relationship to Cumulative Exam Score



Note. N = 229. Chi-square = 529.7, RMSEA = 0.074, CFI = 0.901, TLI = 0.884, SRMR = .067. Bolded paths are significant to the $p < .05$ level. Manifest variables, covariance paths between selected error terms from CFA model and correlation path calculations between latent variables are included and calculated in the above model, however, have been visually suppressed to aid model analysis and interpretation.

constructs. The results of the alternate structural model appear in Figure 3. Goodness of fit indices suggest this path model does not fit the data adequately; however, strong relationships were observed from self-efficacy to intrinsic motivation and in turn academic outcome. In the alternative structural model, the regression path from self-efficacy to intrinsic motivation and from intrinsic motivation to academic outcome are both statistically significant, $p < .05$. The total and indirect effect of self-efficacy on academic outcome was 2.33, whereas the total and direct effect of intrinsic motivation on academic outcome was 4.22.

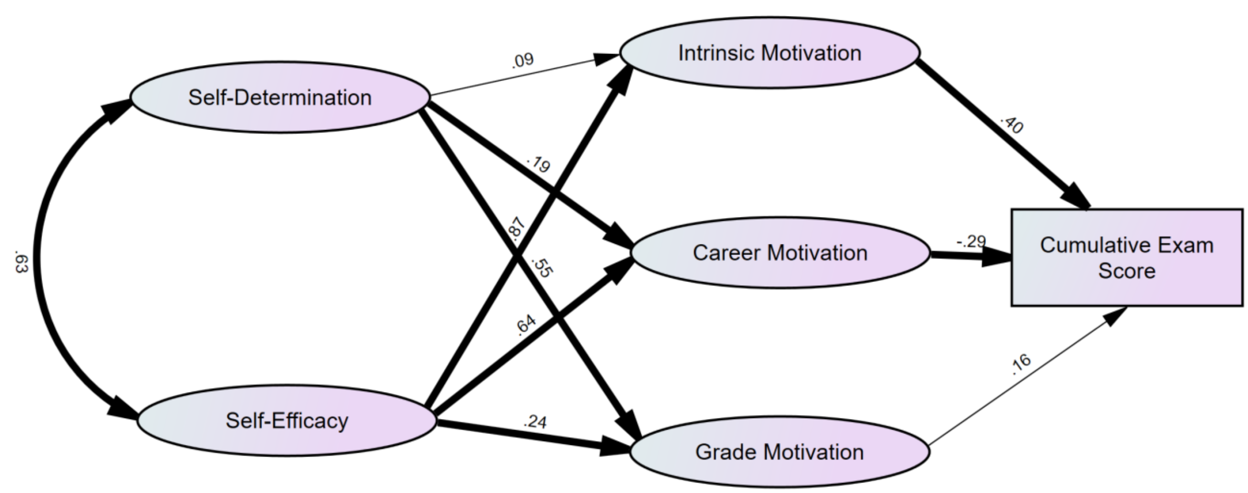
Discussion

Evaluation of the SMQ-II within Collegiate Aviation

The results of the EFA and correlation analysis of the modified SQM-II (Glynn et al. 2011) suggest a reliable survey instrument within the collegiate aviation environment. The CFA suggest opportunity for improvement of construct validity through revision or removal of individual survey items on selected latent variables (e.g. intrinsic motivation and grade motivation). Analysis of discriminant validity suggests possible multicollinearity between intrinsic motivation and career motivation as well as intrinsic motivation and self-efficacy. Multicollinearity may obscure results between affected latent constructs, and within a SEM path diagram, the endogenous variable. As such, researchers who choose to use the adapted the SMQ-II within collegiate aviation should do so with appropriate caution placed on interpretation of

Figure 3

Alternate Structural Model – Self-Efficacy and Self-Determination as Predictors of Intrinsic, Career, and Grade Motivation



Note. N = 229. Chi-square = 591.11, RMSEA = 0.081, CFI = 0.882, TLI = 0.862, SRMR = .071. All bolded regression paths were statistically significant to the p<.05 level. Removal of non-significant paths did not meaningfully improve model fit.

results. A larger sample size or within a more diverse sample frame of collegiate aviation students may yield different results.

The nature of the studied population may also partially explain cross-loading of certain manifest variables onto other factors. In the case of the cross-loading variables, these may be partially explained by the subject population's proximity to career entry and its impact on item response versus the items appropriateness or inappropriateness for inclusion within the scale. In the case of the variable IN3*, "*The aircraft systems I learn are relevant to my life*",* the item loads onto the Intrinsic construct, however, also loads more strongly onto the Career Motivation construct. In this specific example, one could imagine how this question has direct relevance to the pre-career aviator's career motivation and *literally* may impact their life.

SMQ-II as a Predictor of Academic Outcome

Consistent with Bandura's (1986) SCT and prior research by Glynn et al. (2011) self-efficacy showed a strong positive relationship to academic outcome. This relationship of self-efficacy to academic outcome held true in the fully saturated model (Figure 2) as well as the alternate model through intrinsic motivation to academic outcome (Figure 3). The results of this study appear to align with expectations regarding one's belief in their own abilities and how that translates into performing on given task. Airline recruiters and pilot training personnel may find the relationship between a pilot's self-efficacy and his or her performance important to the hiring and qualification processes. Although not statistically significant, the data showed a positive, although weaker, predictive relationship between self-determination and their cumulative exam scores (Figure 2) which aligns with results from prior research by Glynn et al.

Contrary to Glynn et al. (2011) and the theoretical work of Ryan and Deci (2000a), in the fully saturated structural model intrinsic motivation showed a strong negative relationship to the students' cumulative exam scores. Two likely circumstances led to this unexpected result: one statistical and one contextual. As noted by Ryan and Deci, intrinsic motivation reflects the inherent tendency to pursue challenges, explore, and learn (2000a). Students enrolled in this course may not hold intrinsic interest in the study of highly technical aircraft systems, and may in fact, find it boring, overwhelming, or not relevant to their status as collegiate aviation students. A reality of the course is that the students are not currently flying the aircraft they are studying in the course such as the Airbus A320, Boeing 737 or Bombardier CRJ700. As such, the intrinsic motivation survey items "The aircraft systems I learn is relevant to my life" or "Learning aircraft systems is interesting" may not resonate with most students enrolled in the course in a way which translates meaningfully into academic performance. As noted above, it is also possible that multicollinearity with other latent constructs on may affect results of the intrinsic motivation and predictive relationship to a student's cumulative exam score, as observed within Figure 2. If we combine concepts from SCT and SDT into Figure 3, the role of intrinsic motivation on academic outcome appears more in line with prior research.

If we apply Bandura's (1986) approach to SCT and include environmental factors (airline demand for qualified pilots), other alternative explanations for the results may become meaningful. At the time of this study, most participants (70.8%) in this study were enrolled in or intended to be enrolled in an airline pathway program. This environmental factor cannot be ignored as it relates to students' expectations and motivation for entry into the aviation career path. Enrollment or acceptance within a pathway program may indicate that students have preferential hiring arrangements and/or may have been given a conditional job offer by an airline or aviation company of choice. Given this reality, we would expect career motivation to be high and result in a strong relationship to the student's performance on course exams, however, only a weak relationship existed between career motivation and the average exam score. Given the study results showing weak predictive relationship of career motivation on academic performance, there exists a possibility that some form of career path entitlement or presumed job placement may be reflected in the data. Students may assume a job is waiting for them which may serve to nullify any career-related motivations.

There are also demographic differences between the populations studied by Glynn et al. (2011) and those included in the present study. First, the students in this study are predominantly in their fourth year of education and as such are financially and academically committed to a career path in aviation. This point differs somewhat with Glynn et al. (2011) regarding the year of academic performance of the average student participant. These differences may help to explain certain variations in predictive relationships. For example, a fourth-year senior aviation student may have accepted their path as a professional aviator (both cognitively and contractually) and may not value the course grade as much as someone trying to establish an academic pedigree as a freshman in a competitive science field. Additionally, if the student has committed both cognitively and contractually to a particular regional career, military or similar option, the pressure to perform may be partially reduced and not be as strongly witnessed as science major working to compete towards entry into an elite medical school.

Limitations

Due to the specific recruitment process of the participants, the results of this study may limit generalizability to students within collegiate aviation environments and/or academic programs with a clear linkage to professional career pathways. The sample population also was mainly white (83.8%) and male (87.3%) which may further limit generalizability of results to other contexts. The study occurred prior to the COVID-19 pandemic and new data may yield different results as economic and vocational prospects have likely changed. The outcome variable used in this study (average exam score) was somewhat different compared to prior research using the SMQ-II, which used college science GPAs. The outcome variable of average exam score from one course may influence analysis when compared to inclusion of an outcome variable reflecting performance in multiple courses. This research did not consider other background (personal factors) such as family background in airlines or aviation, or if participants had industry mentors. Certain secondary factors may influence motivational responses in one direction or another or otherwise influence the predictive relationship to academic outcome. The study also includes a small amount of missing data that was addressed using similar response pattern matching (SRPM; Byrne, 2016). SRPM was employed to address the missing data which allows for computation of certain fit indices and modification indices (MIs) within the AMOS program.

Conclusion and Future Directions

The airline and aviation industries are continuously evolving to meet economic demands (Boeing, 2019). The employees of these dynamic organizations play a key role in the organization's performance and efficiency. This study, using the adapted SMQ-II (Glynn et al., 2011) presents a window into this dynamic environment, motivation factors of the next generation of aviation professionals. The results of this study suggest that prior research within Social Cognitive Theory (SCT; Bandura, 1986) remain relevant many years later as we understand *self-efficacy* to continues as an important factor within motivation and performance. Airline and industry personnel involved in recruitment, hiring and training of the next generation of aviation professionals may find this information useful as they develop techniques for recruiting, developing and retaining highly qualified aviation professionals. Personnel training and development designed to support an individual's self-efficacy may improve the individual's contribution towards organizational objectives. Opportunities for future research could include inclusion of recruitment instruments which evaluate an individual's self-efficacy prior to hire. Additionally, colleges and universities could develop curricula intended to focus on supporting self-efficacy for students. Finally, future research in this domain could benefit from longitudinal studies involving the role of self-efficacy in career performance of active professional pilots.

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Appendix

Table A1

Science Motivation Questionnaire II (SMQ-II) (Glynn et al., 2011) Adapted to Collegiate Aviation Students

Item ID	Adapted Survey Statement
IN1	Learning aircraft systems is interesting (4)
IN2	I am curious about discoveries in aircraft systems (9)
IN3	The aircraft systems I learn is relevant to my life (14)
IN4	Learning aircraft systems makes my life more meaningful (19)
IN5	I enjoy learning aircraft systems (24)
CM1	Learning aircraft systems will help me get a good job (5)
CM2	Understanding aircraft systems will benefit me in my career (10)
CM3	Knowing aircraft systems will give me a career advantage (15)
CM4	I will use aircraft systems problem-solving skills in my career (20)
CM5	My career will involve aircraft systems (25)
SD1	I study hard to learn aircraft systems (1)
SD2	I prepare well for aircraft systems tests and quizzes (6)
SD3	I put enough effort into learning aircraft systems (11)
SD4	I spend a lot of time learning aircraft systems (16)
SD5	I use strategies to learn aircraft systems well (21)
SE1	I believe I can earn a grade of ''A'' in aircraft systems (2)
SE2	I am confident I will do well on aircraft systems tests (7)
SE3	I believe I can master aircraft systems knowledge and skills (12)
SE4	I am sure I can understand aircraft systems (17)
SE5	I am confident I will do well on aircraft systems quizzes and projects (22)
GM1	Scoring high on aircraft systems tests and labs matters to me (3)
GM2	It is important that I get an ''A'' in aircraft systems (8)
GM3	I think about the grade I will get in aircraft systems (13)
GM4	Getting a good aircraft systems grade is important to me (18)
GM5	I like to do better than other students on aircraft systems tests (23)

Note. Survey adapted from Glynn et al. (2011) substituting the word "science" for "aircraft systems". Survey items were arranged in semi-random order. Numbers at the end of each statement indicate the order of the stem question as it was presented within the survey instrument. Responses range from (Strongly Disagree =1 to Strongly Agree =5). IN = Intrinsic Motivation, CM = Career motivation, SD = Self-Determination, SE = Self-Efficacy, and GM = Grade Motivation.

Table A2

Survey Results by Individual Item

Item	N (Valid)	Mean	Std. Dev.	Skewness	Kurtosis	Range
IN1	229	4.4	0.7	-1.7	5.1	4
IN2	229	4.3	0.8	-1.2	1.8	4
IN3	229	4.5	0.8	-1.9	4.8	4
IN4	229	3.5	1.0	-0.3	-0.1	4
IN5	229	4.2	0.8	-1.4	2.7	4
CM1	229	4.6	0.7	-1.8	4.0	4
CM2	229	4.8	0.5	-3.4	16.7	4
CM3	229	4.7	0.7	-2.6	8.9	4
CM4	229	4.7	0.6	-2.9	11.2	4
CM5	229	4.8	0.5	-4.5	26.3	4
SD1	229	4.2	0.7	-1.3	3.2	4
SD2	229	4.1	0.8	-1.0	2.1	4
SD3	229	4.1	0.8	-1.0	1.4	4
SD4	229	4.0	0.8	-0.7	0.6	4
SD5	229	4.0	0.8	-0.7	0.9	4
SE1	229	4.1	1.0	-1.1	0.8	4
SE2	229	3.8	0.9	-0.7	0.5	4
SE3	229	4.2	0.9	-1.4	2.2	4
SE4	229	4.3	0.7	-1.4	4.1	4
SE5	229	3.9	0.8	-1.1	2.2	4
GM1	229	4.6	0.7	-2.2	6.0	4
GM2	229	4.4	0.8	-1.6	2.9	4
GM3	229	4.5	0.8	-1.8	3.5	4
GM4	229	4.5	0.7	-2.0	5.8	4
GM5	229	4.1	1.0	-0.9	0.4	4

Note. Results include both course offerings face-to-face/blended and online/asynchronous.

STUDY 3

EXAMINING DIFFERENCES IN AVIATION STUDENT MOTIVATION DURING BLENDED VERSUS ONLINE ASYNCHRONOUS COURSES

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Abstract

This study evaluated responses to an adapted version of the Academic Motivation Scale (AMS; Vallerand et al., 1992) to collegiate aviation students at a midwestern university in the United States. The study is informed by Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000a) and sought to investigate motivational differences of students according to their enrollment in one of two course delivery methods. The study compared two groups of senior-level undergraduate students enrolled in an undergraduate advanced aircraft systems course. Seven sections of face-to-face blended (n = 161) were compared with two sections of online, asynchronous (n = 43) to compare for potential differences in motivational attributes evaluated through the AMS. Despite differences in course delivery characteristics, such as the amount of peer-interaction and social-presence as well as the flexibility inherent to the online asynchronous course, results of independent samples t-test did not reveal any *self-selection bias*, or students with shared motivational characteristics to enroll in one delivery method or another. As other studies have shown differences in characteristics of students enrolled in online courses (Deming et al., 2012; Money & Dean, 2019; Nguyen, 2015), this result is an important addition to the research literature available to administrators, faculty and curriculum designers within the collegiate environment. To ensure effective course design, further study is warranted with instruments outside of the AMS to determine presence of other potential student differences of those enrolled in online courses.

Keywords: Online education, blended, academic motivation, selection-bias, aviation

Examining Differences in Aviation Student Motivation During Blended Versus Online Asynchronous Courses

O*nline education* is a growing presence in higher education (Seaman et al., 2018). Its origins can be dated back to the mid-1970s with the advent of email and similar electronic conferencing (Harasim et al., 1996). As technology, computing, learning management systems, and the myriad of visual presentation methods have come available, interest in online education seems to have followed (Seaman et al., 2018). Many studies have evaluated effectiveness of online education (Nguyen, 2015), and within different disciplines (Means et al., 2009). Additionally, practitioners have evaluated and offered best practices of online education in selected learning environments (Johnson et al., 2014).

There are also documented differences in which student populations tend to enroll in online versus traditional face-to-face courses (Deming et al., 2012; Money & Dean, 2019; Nguyen, 2015). Typically, online courses have the benefit of being more flexible for the student and may tend to attract non-traditional learners at a greater rate than brick-and-mortar alternatives (Deming et al., 2012; Lei & Lei, n.d.). Research is expanding into understanding motivation and academic outcomes of populations who enroll in online versus traditional forms of education (Artino & Stephens, 2009; Francis et al., 2019; Stewart et al., 2010). The present study seeks to expand this developing area of research into the collegiate aviation population. The purpose of this study was to test if students who enroll in blended face-to-face or online-asynchronous courses share common motivational attributes as observed through the Academic Motivation Scale (Vallerand et al., 1992). The article will start with a review of Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000a) and then review of the current state of research on motivation in online education.

Self-Determination Theory (SDT)

SDT is one mechanism by which educators, personnel managers and social psychologists understand human behavior within a particular contextual environment (Deci & Ryan, 1985; Ryan & Deci, 2000a). In the case of this study, SDT may inform our understanding of collegiate aviation student motivation within asynchronous online and blended learning environments. The three basic psychological needs (BPN) of SDT include an individual's need to demonstrate competence, their need for autonomy over actions and choice, and a desire to relate to others with whom they interact and who care for their well-being. An individual's attainment of the BPNs act as antecedents and are theorized to manifest into varying types and degrees of motivation (Ryan & Deci, 2000b). The perspective of the present study and the original use of the Academic Motivation Scale (AMS) (Vallerand et al., 1992) are founded in SDT.

Furthering the research into SDT, Ryan et al. (2009) refined the types of extrinsic motivation along a continuum from less autonomous to more autonomous. Starting with motivation from less autonomous (i.e., controlled) sources, Ryan et al. (2009) described *external regulation* where the individual performs behaviors simply to seek an outside reward or avoid a punishment. *Introjected regulation* describes an individual's task performance to feel better about him/herself or to avoid negative impact to self-esteem. Moving towards more autonomous motivation, an individual may be driven to perform actions which they personally identify with, referred to as *identified regulation. Intrinsic motivation* is the inherent joy or pleasure witnessed through performing a particular activity. On the other end of the motivation spectrum *amotivation* describes a fundamental lack of intention to perform a particular task or activity (Ryan et al., 2009; Vallerand et al., 1992).

To fully apply SDT, it is important to understand the context in which the study occurs. A short summary of distance and online education follows along with growing research into online education in aviation as well as research into motivation and online education.

Distance and Online Education

Distance education has documented origins as early as the mid-1800s (Kentnor, 2015; Lee, 2017; Verduin & Clark, 1991). One example of this model included efforts at the University of London which identified students whom were previously excluded from participation in higher education, such as women and minorities (Lee, 2017). In approximately the late 1960s, a model called the Open University of the United Kingdom, further expanded access to distance education, continued in the form of correspondence study witnessed in earlier examples (Lee, 2017). "This approach served the long-standing goal of distance education to increase access, especially for the educationally disadvantaged" (Garrison & Cleveland-Innes, 2010, p.16). As infrastructure and technology continued to expand, so did access to distance education.

Online education, a form of distance education, arrived with the advent of internet-enabled devices and represents, "a range of practices based on the Internet that provides synchronous and asynchronous communication in a personal and group environment" (Garrison & Cleveland-Innes, 2010, p.22). Stated differently, online education allows teachers and learners to interact at a distance using web technologies to close that gap (Lee, 2017). As instructors and students realized how technology could facilitate learning and exchange of knowledge, the available course offerings and facilitating technologies expanded rapidly.

Fast forward to present day learning environments, students and instructors interact in a variety of technology-facilitated manners. Examples include live video-conferencing in the classrooms, which include both face-to-face students and students working in disparate locations across the state, country or globe. Other examples of how technology facilitates online education includes remotely-proctored exams, such as via companies like ProctorU, that allow a student to take a computer-based exam while being video-monitored by a third-party. Tools such as ProctorU allow significant flexibility to be enjoyed by the learner as well as the instructor of the course.

Structure and delivery of online courses may vary in one of several general structures. Online courses may be *synchronous*, whereby the instructor and students meet during a specified time for discussion and activity (Merriam & Bierema, 2014). During a synchronous online course, the experience of observing each other's non-verbal cues and hearing voices and concurrent feedback from instructors and peers may not be notably different than a brick and mortar learning environment. Online education may also be *asynchronous*. In this arrangement, students are not meeting the faculty member during a specified time and place to accomplish academic objectives. Typically, there are a set of readings, videos, lesson homework or projects in which the students must complete. Student deliverables may come with a structured milestone schedule or they may simply all be due prior to the end of the term. Decisions on course design are typically the volition of the instructor, and therefore will vary just as traditional face-to-face courses have today. Courses may also be delivered *blended* instruction, which includes a combination of face-to-face and online (Merriam & Bierema, 2014). There are a variety of characterizations of hybrid or blended courses, however, the terms generally refer to use of information delivery in an online environment (outside of the classroom) paired with some element of face-to-face or "seat time" with an instructor and classmates (Lei & Lei, n.d.; University of Wisconsin, 2020). Typically, lectures or other course material are covered outside the classroom, where peer interactions and material application with course material occur in a formal setting (e.g. labs or problem-based learning) (Lei & Lei, n.d.).

Student Motivation and Performance between Online and Traditional Education Formats

A growing body of research continues to evaluate differences in student motivation and performance between course delivery methodologies. Francis et al. (2019) studied motivation and performance of over 2,400 community college students enrolled in either online or face-to-face developmental math courses. The authors found student motivation did not differ significantly across course delivery methods, yet online students received lower grades and were more likely to drop out. Additionally, the results suggested that status as an adult learner predicted lower academic outcome and higher dropout in online environments. Artino and Stephens (2009) reviewed academic motivation and self-regulation of undergraduates and graduates learning online. The research suggested no difference between graduate and undergraduate students within task value or self-efficacy, but statistically significant difference regarding continuing motivation, the undergraduate group reporting higher intention to enroll in future courses offered online. Research by Stewart et al. (2010) suggested, "students had clear preferences with regard to delivery mode and the factors that motivated students to complete traditional degrees were the same factors that motivated students to complete online degrees" (p. 375). Yet, the Stewart et al. continue to suggest differences in extrinsic motivators, such as time constraints and home responsibilities between online and traditional students. On the topic of student success, Johnson and Mejia (2014) cite that students enrolled in online courses in California's community colleges are less successful than in traditional courses. Research continues to expand into online and traditional education more broadly, yet this area of research remains limited within aviation education. A summary of relevant research of distance and online education within collegiate and professional aviation is included below.

Distance and Online Education in Aviation

There is a limited body of research on distance and online education within the collegiate aviation and airline domains. Kearns (2016) authored a text focusing on theory, effectiveness and topics related to instructional design for e-learning within aviation. Prather's (2018) research used survey data to gather opinions on awareness, effectiveness, and interest in distance learning versus face-to-face options for individuals interested in careers in airport operations. Prather's research suggested individuals may have concerns over quality of distance degree programs, but also viewed them as more flexible. Scarpellini and Bowen (2018) conducted a phone-based qualitative survey to gather information on assessment of distance degree programs within collegiate aviation institutions. Raisinghani et al. (2005) conducted a survey of business aviation professionals and their attitudes towards online training. Their research suggested such factors as efficacy, compatibility, and perceived usefulness as being important to the business aviation pilot. The research by Raisinghani et al. suggests stakeholders were aware of and planning for the arrival of distance and online education within aviation almost two decades prior to the current study. As limited research exists on this topic within the collegiate aviation environment, the present study seeks to add to the body of knowledge of student motivation and performance as these students choose between enrollment in blended and online, asynchronous course delivery.

Learning and Motivation with Generation Z

Generation Z are identified as those born between the years of 1995 and 2010 (Seemiller & Grace, 2017; Mohr & Mohr, 2017). As it relates to this study, most of the student participants would be considered members of Generation Z during the years 2018 and 2019. Generation Z shares many similarities to their well-researched predecessors, the Millennials, however, have been identified as having a distinct set of traits from the prior generation. Generation Z, also referred to as the *Digital Natives,* are documented to have more access to information than any prior generation at their age (Seemiller & Grace 2017). Additionally, Generation Z has more economic well-being, is more highly educated and is more diverse (Schroth, 2019; Mohr & Mohr, 2017). Schroth also cites that the Digital Natives are less likely to have worked when they were young and are more likely to experience or be diagnosed with anxiety and depression. Potentially related to these latter points, the author also suggests that overprotective parenting impacted their ability to learn life skills and has made it "difficult for them to become autonomous adults" (Schroth, 2019, p.10). Generation Z's relationship with technology, also resulting in their descriptive secondary moniker, has negatively impacted traditional means of face-to-face communication. Schroth (2019) states in reference to over-reliance on technology, "this can impair their ability to effectively communicate and interact with others" (p.13). As evidence of their comfort with technology and education, it has been cited that Generation Z students prefer flipped courses and rely on sites such as YouTube for instruction (Seemiller & Grace, 2016; Mohr & Mohr, 2017). Yet, for this cohort, preference for and comfort with technology may not translate well into skills needed in the workplace. It is within this context that additional study of generational motivation towards traditional, blended and online, asynchronous learning should occur and be evaluated against performance of employee cohorts post "onboarding". This study represents one such data point.

Selection Bias

Sample (selection) bias may occur when members of a sample differ from the larger population in a systematic fashion (Blair et al., 2014). Selection bias can occur with quasi-experimental (non-random) samples when unobserved characteristics of participants differ meaningfully between groups and membership in one group or another is correlated with the unobserved characteristic (Deschacht & Goeman, 2015). In the case of online education more broadly, there have been assessments of such selection bias; focusing primarily, although not exclusively on issues such as socioeconomic status, race, gender and age. Deming et al. (2012) evaluated for-profit providers of online education and found, "the for-profit sector disproportionately serves older students, women, African-Americans, Hispanics, and those with low-incomes" (p.146). Money and Dean offered a much more comprehensive approach to the analysis of online student differences, they also reiterate that participants in online education tend to be older as well as more economically and socially disadvantaged (2019). What remains is to expand our understanding of selection bias outside of socioeconomic, gender, race or class and evaluate more subtle differences, such as motivation, in student populations. No difference between groups in student motivation would suggest that a student with a degree in Commercial Aviation is a student with a degree in Commercial Aviation. How they received the degree would matter little. A statistically significant result would suggest more advantageous or problematic outcomes for the career pathway as it would suggest that students may self-select into certain academic/course options due to personal or motivational differences. These individual differences are not likely to be accommodated in a highly standardized, highly regulated aviation industry.

The purpose of the current study is to evaluate for differences in motivation between students who enrolled in either a blended section or online, asynchronous section of a senior-level advanced aircraft systems course. The Academic Motivation Scale (AMS; Vallerand et al., 1992) will be used to evaluate for differences on five subscales, including *Intrinsic Motivation, Identified Motivation, Introjected Motivation, External Regulation,* and *Amotivation.* Informed by SDT (Deci & Ryan, 1985; Ryan & Deci, 2000a), this is expected to inform our understanding of the relationship of collegiate aviation student motivation and course delivery.

Methods

Procedure

Students enrolled in a senior-level advanced aircraft systems course at a Midwestern United States research university were recruited to complete an Qualtrics online survey. Aviation undergraduate students who were enrolled in this advanced systems course were recruited to participate through in-class announcement followed by email link to the survey from the course instructor. The sampling frame included seven course sections utilizing a blended, face-to-face design and two sections using an online, asynchronous design. A total of 243 participants were invited to participate of which (N = 204) responded, yielding an 83.9% response rate. The students in the study included (n = 161) blended, face-to-face environment or entirely (n = 43) online, asynchronous methods. Students were provided the survey online via Qualtrics survey tool after completion of approximately 75% of the academic term.

Participants

All participants in the study were collegiate aviation students enrolled in a four-year aviation baccalaureate program. By virtue of enrollment in the course in which the study was conducted, all students had previously completed coursework and Federal Aviation

Administration (FAA) requirements to possess a commercial pilot certificate with single-engine, multi-engine, and instrument ratings. Inclusive of the two experimental groups, the mean age of the participants was 22.1 (SD = 3.07) years including 13.2% female students. Racial identity was reported as White (84.3%), Asian (6.9%), more than one race (2.9%), Black or African American (0.5%), Native Hawaiian or Pacific Islander (0.5%), or not reported (4.9%). Participants indicated senior-status (82.8%), junior status (16.7%) and sophomore status (0.5%). Participants reported a mean college GPA of 3.45 (n = 159) for the blended course and 3.50 (n = 43) for the online asynchronous course as well as a self-reported ACT score of 25.7 (n = 102) for the blended course and 25.8 (n = 27) for the online asynchronous course. Most participants (72.1%) were enrolled in or intended to enroll in a defined career pathway program associated with a commercial airline.

Measures

Motivation was measured using the Academic Motivation Scale (AMS) developed by Vallerand et al. (1992) and adapted to the collegiate aviation environment. The survey instrument was comprised of five constructs each containing four manifest variables assessing types of motivation: Intrinsic Motivation, Identified Motivation, Introjected Motivation, External Regulation, and Amotivation. See Table 1 for example statements for each motivation subscale. The survey response options were provided on a five-point Likert-type scale. Responses range from: 1 = *Does not correspond at all*, to 5 = *Corresponds exactly*.

Results

Survey data was downloaded to SPSS and three cases of non-response to the AMS were excluded and similar response pattern matching (SRPM; Byrne, 2016) was applied to isolated

Table 1

Example Statements Represented by Motivational Subscales

Motivation Sub-Type	Exemplar Statement
Intrinsic	"Because I experience pleasure and satisfaction while learning new things."
Identified	"Because eventually it will allow me to enter the job market in a field that I like."
Introjected	"To prove to myself that I can do better than just a high-school degree"
External Regulation	"In order to get a more prestigious job later on."
Amotivation	"Honestly, I don't know. I really feel that I'm wasting my time in college.

Note. (Vallerand et al., 1992, p. 1008). Subscales arranged from most self-determined (intrinsic) to least self-determined (amotivation).

datapoints within six cases to complete datapoints missing at random yielding (N = 204) responses. Participants were coded as belonging to one of two groups: (1) blended/face-to-face section (n = 161), or online-asynchronous course (n = 43). To assess internal consistency of the AMS within a new discipline, reliability analysis was performed in SPSS for each of the defined motivational subscales. Cronbach's alpha ranged from .74 to .87 (Table 2). Each of the four individual sub-scale items were averaged into new variables representing their pre-established motivational subscale (amotivation, intrinsic, etc.) adapted from the AMS (Vallerand et al., 1992). A correlational analysis was completed in SPSS and results are shown in Table 2. A exploratory factor analysis (EFA) was performed on the 20 individual survey items. Using principal axis factoring, a five-factor fixed solution was defined based on the original AMS using oblimin rotation. The results are consistent with the original AMS except for one survey (Ext_ID4) which showed stronger loadings on the *intrinsic* motivation sub-scale. Results of the EFA factor loadings are shown in Appendix, Table A3.

Table 2

Reliability and Correlation of Composite Exam Score to AMS (N = 204)

	Intrinsic	Identified	Introjected	Externally Regulated	Amotivation	Cronbach's α
Exam Score	.02	.05	-.04	.02	-.11	
Intrinsic	1					0.84
Identified	.64*	1				0.77
Introjected	.51*	.52*	1			0.87
Externally Regulated	.35*	.44*	.51	1		0.74
Amotivation	-.36*	-.49*	-.15	-.12*	1	0.83

Note. *p <.05. Correlational analysis includes observations recorded during last quarter of offered term of blended face to face and online, asynchronous course.

Next, a confirmatory factor analysis (CFA) was performed using the Analysis of Moment Structures version 27 (AMOS; Arbuckle, 2017). Individual factor loadings and fit indices of the measurement model suggested acceptable fit with some opportunity for improvement (Chi-square = 322.91, RMSEA = 0.07, CFI = 0.92, TLI = 0.90, SRMR = 0.07). Model fit was improved after review of modification indices (MIs) suggested addition of two covariance paths between two separate sets of error terms on separate latent constructs. Final model fit was deemed acceptable for further analysis (Chi-square = 281.73, RMSEA =0.062, CFI =0.938, TLI =0.926, SRMR =0.064). Analysis of convergent validity was performed by calculating average variance extracted (AVE) for individual subscales. Evidence of convergent validity was shown on the intrinsic, introjected, and amotivation subscales. Moderately low factor loadings on external regulation and identified scales suggested inadequate convergent validity. Lastly, the adapted AMS was evaluated for discriminant validity through comparison of the average AVE between constructs to the squared bivariate correlation between the compared latent constructs. The instrument showed evidence of discriminant validity between all scales except for between the intrinsic and identified scales. Overall, the adapted AMS showed acceptable validity within this sample population.

To assess for potential differences in motivational attributes of students, independent samples *t*-tests were performed between the two groups of students enrolled in the blended face-to-face versus online/asynchronous sections. Manifest variables of each scale were summed into new average variables representing the subscale and the *t*-tests were performed on each of the five motivational subscales included in the AMS. Results suggests no difference in motivational attributes on individual subscales of the adapted AMS between students enrolled in the two different course delivery methods.

As the original AMS study by Vallerand et al.(1992) noted differences in certain motivational subscales by a participant's gender, independent samples *t*-tests were also performed on the five motivational sub-scales by gender for the combined courses ($N = 204$). Although data approaches significance for Intrinsic Motivation and Amotivation, statistical tests suggest no difference in academic motivation by a participant's gender when combining responses between both delivery methods.

The data suggests no difference in the students within the two delivery methods as well as no difference in reported motivation on any subscale when evaluated by a students' gender. The researcher was then interested to see if any of the subscales appeared to be predictive of academic performance. To accomplish this test, the researcher included all five of the subscales into a simple linear regression model as the independent variables and the students' averaged exam score as the dependent variable. No individual subscale appeared predictive of the academic outcome and the overall model was not significant, $F(5,198) = 0.679$, $p>0.05$.

Discussion

Self-Determination Theory (Deci & Ryan, 1985) suggests that individuals have a need for autonomy, competence and an ability to relate to others. As we change our course design to embrace technology and increase flexibility for the learner, one could postulate potential changes to levels of autonomy and relatedness available to the learner between the course delivery methods. It was within this domain that the researcher sought to re-evaluate the AMS (Vallerand et al., 1992) to assess for potential differences in student motivation as they progress along their learning path within the aviation discipline.

Results of the present study show similar internal reliability compared to the original assessment of the AMS, with no notable differences in Cronbach's alpha between the two. This result suggests that modification of the AMS to the aviation discipline does not negatively impact scale-reliability. Correlation between the motivation subscales also appear to have expected outcomes with all forms of external motivation (e.g. identified, introjected and externally regulated) showing positive correlation with each other, as well as intrinsic motivation showing moderately strong, positive correlation to the three other measures of external motivation. As expected, the amotivation subscale shows negative correlation to all other motivation subscales ranging from weak to moderately strong negative correlation, particularly with identified motivation. It would be expected for a pilot to show amotivation (lack of amotivation) if she/he is not able to recognize who their present actions affect their ability to achieve a career goal in the future.

Given the difference in course delivery method and the potential for students to self-select into a method where there are substantially lower amounts of peer interaction (relatedness) yet higher amounts of flexibility (required autonomy), the non-significant results of the independent samples t-tests were less expected. Although the prior academic preparation (GPA, ACT score) and age were not statistically different between the two delivery methods, the researcher expected to observe some student differences in the motivational scales between the blended/face-to-face group and the online/asynchronous group. Similarly, as there were previously gender differences noted in the first publication of the AMS, the researcher also expected to see potential for statistically significant differences between gender. Although there were differences in the mean responses for intrinsic (p = 0.059) and amotivation (p = 0.062) between genders, the results did not reach the level of significance. As additional data is collected, re-assessment of these two subscales for gender differences may be warranted.

The non-significant results between course delivery methods are a favorable outcome when considering the rising prevalence of online courses and programs in many fields (Seaman et al., 2018). Through use of the AMS, the results of the study suggest that senior-level collegiate aviation students do not self-select into one course delivery method or another as a result of internal, personal factors associated with differing types of motivation, at least within the enrolled course. This result could suggest that the students' choice of enrolled course and the ultimate degree awarded may not be indicative of underlying motivational differences, when controlling for age and prior academic performance (GPA, ACT score). Airline and aviation recruitment may consider this as one piece of evidence to suggest that student enrolled in online education do not meaningfully differ across subsets of motivation.

Limitations

Data provided in this sample includes survey responses from collegiate aviation students within multiple consecutive sections of the same course, offered in two different course delivery methods. Due to the unique discipline of the sample population (aviation), the results of the study have limited generalizability to a broader population. On the topic of demographics, the sample population was predominantly white (84.3%) and male (86.8%). The study did not include enough representation across underrepresented populations to make meaningful statistical inferences. Expanding the study to include more students from underrepresented groups may yield differences across motivation. Finally, this study only included five subscales of motivation. Further research could be improved through inclusion of other psychometric scales useful to expanding our understanding of student differences in online and traditional education.

Implication for Practice

Despite changing enrollments across much of higher education, student enrollments in distance (online) education continues to rise (Seaman et al., 2018). Online courses offer a high degree of flexibility and offer the learner access to educational advancement without the limitations associated with attendance at a physical brick-and-mortar institution. Yet, there are many advantages and disadvantages of online courses compared to traditional face-to-face courses. Online, asynchronous courses require a higher degree of autonomy compared to traditional face-to-face or hybrid courses and also typically witness lower amounts of peer interaction (Lei & Lei, n.d.). Hybrid or blended courses, on the other hand, allow for continued peer interaction, instructor feedback and – presumably due to regular meetings – require the learner to require less autonomy than a comparable online asynchronous course.

Given the differences in course offering, the researcher sought to use this quasi-experimental design to assess for potential student self-selection into one of the two methods of course offerings; blended/face-to-face and online/asynchronous. To assess for such differences in motivation, the researcher adapted the AMS (Vallerand et al., 1992) to the collegiate aviation discipline. Reliability analysis of the adapted scale proved similar results to the AMS. Additionally, a confirmatory factor analysis was performed on the data and showed acceptable construct validity for use within the sample population. Ultimately, independent samples *t*-test results did not suggest any difference in motivational attributes on the adapted AMS between the two groups of students by course delivery method or by gender. As Academia-at-large continues to offer more courses in online or distance formats, the results of this study offer another data point into our understandings of student motivation in various forms of traditional and online education.

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Appendix

Table A1

Academic Motivation Scale (AMS), Adapted to Collegiate Aviation Students from Vallerand et al. (1992)

Item ID	Adapted Survey Statement
Intrin1	Because I experience pleasure and satisfaction while learning new things.
Intrin2	For the pleasure I experience when I discover new things never seen before.
Intrin3	For the pleasure of broadening my knowledge about subjects that appeal to me.
Intrin4	Because my studies allow me to continue to learn about many things that interest me.
ID1	Because I think an aviation degree will help me better prepare for the career I have chosen.
ID2	Because eventually an aviation degree will enable me to enter the job market in a field that I like.
ID3	Because an aviation degree will help me make a better choice regarding my career orientation.
ID4	Because I believe the additional investment required of the aviation degree will improve my competence as an aviation professional.
Introj1	To prove to myself that I am capable of completing my aviation degree.
Introj2	Because of the fact that when I succeed in my aviation program I feel important.
Introj3	To show myself that I am an intelligent person.
Introj4	Because I want to show myself that I can succeed in my aviation program.
ER1	Because with only a high school education I would not find a high-paying job later on.
ER2	In order to obtain a more prestigious job later on.
ER3	Because I want to have "the good life" later on.
ER4	In order to have a better salary later on.
Amot1	Honestly, I don't know; I really feel that I am wasting my time in my aviation program.
Amot2	I once had good reasons for being in my aviation program; however, now I wonder whether I should continue.
Amot3	I can't see why I am in my aviation program and frankly, I couldn't care less.
Amot4	I don't know; I can't understand what I am doing in my aviation program.

Table A2

Survey Results by Individual Item

Item	N (Valid)	Mean	Std. Dev.	Skewness	Kurtosis	Range
Intrin1	204	4.0	0.8	-0.5	-0.1	4
Intrin2	204	3.9	1.0	-0.7	-0.4	4
Intrin3	204	4.1	0.9	-0.7	0.3	4
Intrin4	204	4.1	0.9	-0.8	0.5	4
ID1	204	4.7	0.7	-2.4	7.0	4
ID2	204	4.5	0.8	-2.0	5.0	4
ID3	204	4.0	1.0	-1.0	0.6	4
ID4	204	4.3	0.9	-1.5	2.2	4
Introj1	204	3.7	1.2	-0.7	-0.3	4
Introj2	204	3.7	1.2	-0.6	-0.5	4
Introj3	204	3.2	1.3	-0.3	-0.9	4
Introj4	204	3.8	1.2	-0.8	-0.3	4
ER1	204	3.3	1.3	-0.3	-0.9	4
ER2	204	4.3	1.0	-1.4	1.9	4
ER3	204	4.0	1.0	-0.9	0.1	4
ER4	204	4.0	1.0	-0.8	0.2	4
Amot1	204	1.4	0.8	2.8	8.9	4
Amot2	204	1.5	0.9	2.0	3.5	4
Amot3	204	1.2	0.6	3.9	17.5	4
Amot4	204	1.2	0.6	3.6	15.7	4

Note: Results include both course offerings face-to-face/blended and online/asynchronous.

Table A3

Factor Analysis and Pattern Matrix

	Factor				
Item	1	2	3	4	5
Intrin1	0.77				
Intrin2	0.73				
Intrin3	0.78				
Intrin4	0.55				
ID1					0.46
ID2					0.75
ID3					0.45
ID4	0.41				
Introj1				-0.82	
Introj2				-0.57	
Introj3				-0.76	
Introj4				-0.82	
ER1			-0.48		
ER2			-0.46		0.30
ER3			-0.74		
ER4			-0.76		
Amot1		0.80			
Amot2		0.65			
Amot3		0.92			
Amot4		0.65			

Note. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.

Discussion and Conclusions

Why Study Aviation Student Motivation?

For nearly 15 years, the primary author of these articles has been involved in supervising airline employees, training airline pilots, as well as educating the next generation of aviation professionals within the collegiate environment. During this time, the author has been afforded ample opportunity for informal observation on what appears to motivate these individuals to perform. In the course of these observations, there has been periodic opportunity to discuss individual factors that contribute to their interest and desire to put forth effort towards a goal. Embarking on a formal research endeavor seemed to be the natural next step.

For the seasoned professional pilot, motivation appears to focus on external motivators leading to a better lifestyle (e.g. base location, better schedule, or higher financial compensation) (Efthymiou et al., 2021). Future research may inform our understanding of professional pilot motivations such as individual prestige or intrinsic interest as they seek to fly a more complex aircraft and seek to understand its inner operations. For the collegiate aviation student, research into individual motivators to perform is developing, yet more research remains. Students may or may not fully understand the implications of their career choice on their personal lives during college preparation, which may influence intrinsic and identified motivation. According to the second study, the primary determinant of a student's performance is strongly supported to be their self-efficacy, or their belief in their own abilities (Bandura, 1986), versus other external motivators. At some during development and transition into the career path, it is quite possible that individual motivation to perform shifts from self-efficacy towards other external rewards.

Generational Factors

In the first study, one impetus for research was related to potential for generational differences to create perceptions of new hire pilot technical and professional preparation. The pilots hired and assessed during the time of the first study experienced strong employment conditions, notably different than peers in preceding years (Lutte & Lovelace, 2016; Peterson, 2008; Regional Airline Association, 2019; Samost, 2018). Research into the topic of generational differences in motivation is on-going in many fields and not directly assessed within the scope of these articles, yet continued research into the topic may further inform our understanding of the relationship between motivation and performance.

Prior research into generational differences in motivation appears mixed with limited practical outcomes within the workplace (Becton et al., 2014; Jurkiewicz & Brown, 1998). Recent research from South Africa, suggests no significant difference between extrinsic and intrinsic motivation between generations, yet satisfaction with levels of autonomy do appear to differ across Gen X and Gen Y groups (Heyns & Kerr, 2018). However, it should be noted that sociocultural differences examined within any single country may lead to other outcomes if research is conducted elsewhere. Similar to the generational research in South Africa, earlier research by Jurkiewicz and Brown (1998) did not show differences between Generation X and Baby Boomers involved in public service as to their desire to contribute to society. Research on the most recent generational cohort, Generation Z, continues to evolve and inform our understanding of their preferences and motivations (Seemiller & Grace, 2016). Given the varied results on intergenerational research, any potential differences witnessed within newly hired airline pilots may be less predicative based on the generational cohort studied and more dependent on employment conditions witnessed at the time of hire and pre-career development period. More research is needed on the relationship of market conditions to new-hire professional pilots' attitudes and vocational performance.

Pedagogical Method and Workforce Training

The third article sought to answer the question as to whether different course delivery methods attract students with different internal motivation profiles. The evidence does not suggest any difference between motivational attributes between those who enroll in a blended course environment versus an entirely online, asynchronous method; one which may require more self-regulation or self-directed learning. This last manuscript could be considered a re-assuring datapoint for training managers within airlines as no differences are observed in pedagogical cohorts as far as their reported motivation. The data suggests that regardless of the preparation method provided, assuming other factors equal, a student who selects blended methods of learning appears to show similar motivations to those who select more individual, asynchronous methods of learning. Evaluation of new-hire motivation and available training options should be regularly evaluated as collegiate aviation and (potentially less-structured) vocational training methods evolve.

Temporal Relevance - Point in Time Assessment of Motivation

One of the most important considerations, one may also call a limitation or a caveat, is that this research was conducted within a specific time period: Fall 2018 through the end of 2019. As listed elsewhere in this document, the hiring conditions for airline pilot candidates during this timeframe was strong and competition for such employees was significant. These conditions have since changed since the onset of the COVID-19 pandemic and student attitudes towards their profession and personal motivations may change as a result. On-going research relating to changes in motivation and career interest may yield markedly different outcomes in 2021 versus in 2019.

Bandura's tripartite reciprocal determinism (1986) or the interplay between an individual's thoughts, their behaviors, and the environment may inform potential changes in attitude pre- and post-pandemic. It is possible that conditions which have evolved since the first quarter of 2020 will change how students feel about their careers and subsequently cause them to take different actions to manifest their career intentions. Similarly, how will collegiate aviation student motivations change assuming that employment within an airline is now less certain in the near-term? Or now that they see how dynamic employment conditions may be in their chosen path? Will only those students who have strong self-efficacy and demonstrate self-regulation be successful transitioning into the career path? Further research is needed to answer these questions as technological, pedagogical and economic forces continue to evolve.

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