Collegiate Aviation Review International

Volume 39 | Issue 2 Peer Reviewed Article #10

12-02-2021

Assessing Motivation as Predictors of Academic Success in Collegiate Aviation Classrooms

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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 (SMQ-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.

Recommended Citation:
Wilson, N. & Stupnisky, R. (2021). Assessing motivation as predictors of academic success in collegiate aviation classrooms. *Collegiate Aviation Review International,* 39(2), 200-217. Retrieved from http://ojs.library.okstate.edu/osu/index.php/CARI/article/view/8376/7683

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 professionals, each interested in securing a coveted seniority number at a select airline or commercial aviation operator. These conditions provided a 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 that appear to influence the academic performance of pre-career aviation students?

In the present study, we examined the relationships of a set of motivation constructs adapted from the Science Motivation Questionnaire-II (SMQ-II; Glynn et al., 2011), including Intrinsic Motivation, Career Motivation, Self-Determination, Self-Efficacy, and Grade Motivation. The adapted SMQ-II survey was provided to senior-level aviation students and combined with their academic outcome represented as an average exam score in a technical systems course. The academic course in which this study was conducted was meaningful for several reasons, primarily the temporal proximity to career entry as well as the subject matter and method of delivery of the course content. To explain further, participants were pre-career aviators studying aircraft types that they would 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. The timing and content associated with the course in which this study was undertaken are critical as the participants 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 professionals' 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 in demand in air travel has placed significant pressure on the supply of commercial pilots. Sources of qualified pilots, such as currently 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 careers. Offering theoretical perspective into this research, relevant motivational theories and concepts are described 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 the 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 the number of hours spent to complete flight lessons (Forsman, 2012). In the current study, students may demonstrate an 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 an 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 the 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 the 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 the midwestern United States. The course was selected as it was in the fourth year of the academic curriculum and studied subject matter directly applicable and in a similar delivery method to students' intended career path. 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 the 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 with a specific context. 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 handling 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. 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 was 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 a 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 the inclusion of covariance paths between a selection of 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, the 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).

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

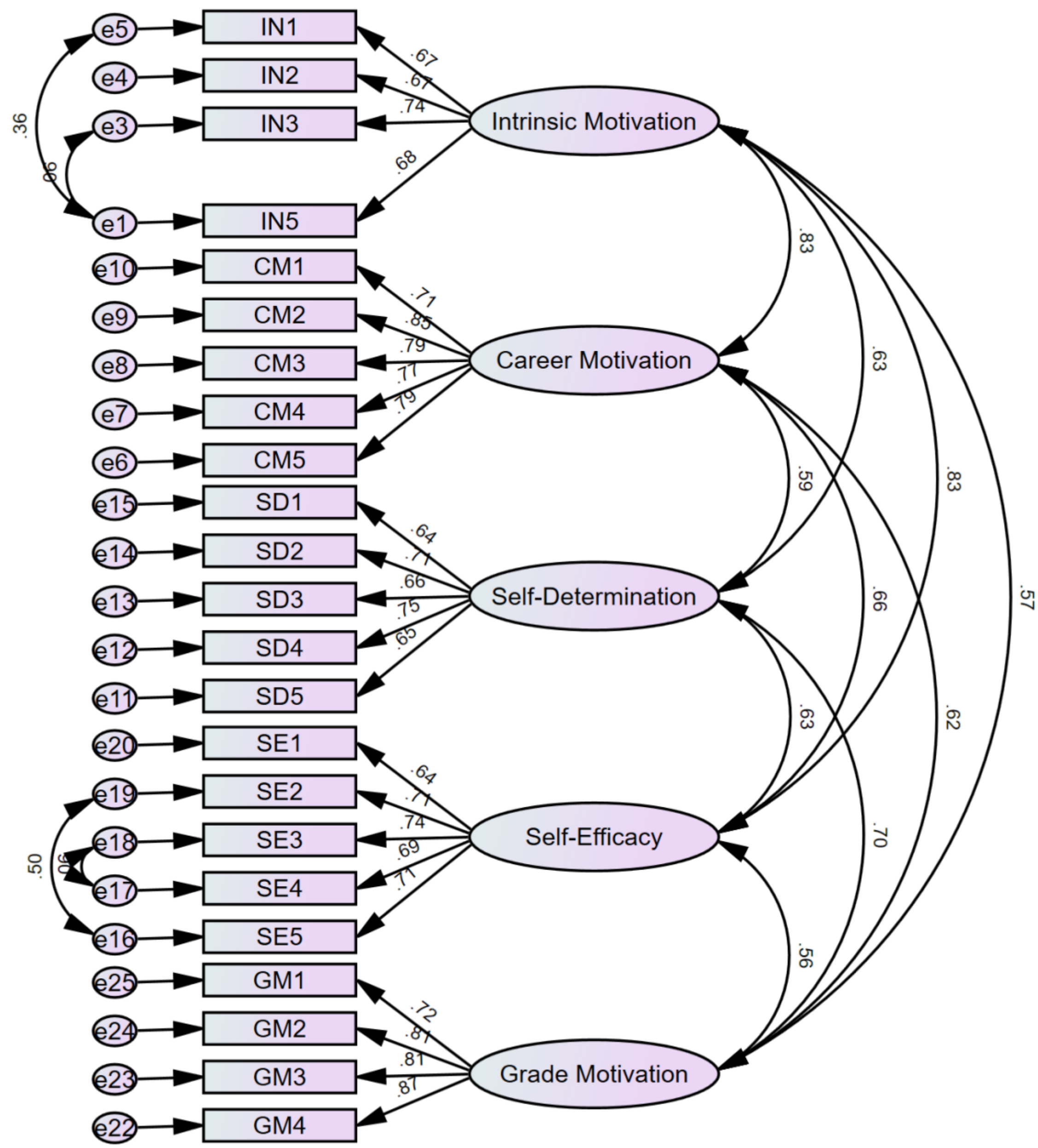

Figure 1. Confirmatory Factor Analysis using SEM, Revised Model

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

Using the revised CFA model, analyses of convergent and discriminant validity were performed. Evidence of convergent validity was first evaluated by a 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, which 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 the average AVE between the two latent constructs is greater than the square of the bivariate 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 the 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 predictive relationships are noted between self-determination, career motivation, and grade motivation and the students’ academic outcome (cumulative exam score).

Bolded paths are significant to the $p < .05$ level. Manifest variables, covariance paths between selected error terms from the CFA model, and correlation path calculations between latent variables are included and calculated in the above model. However, they have been visually suppressed to aid model analysis and interpretation.

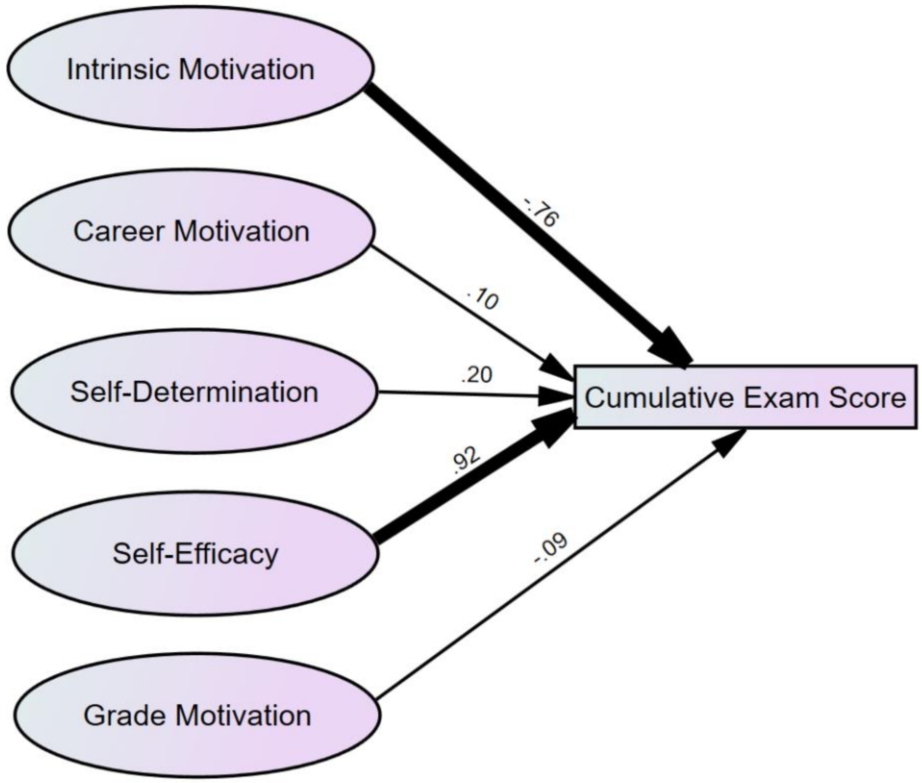

Figure 2. Motivation Construct SEM and Relationship to Cumulative Exam Score

Note: N=229. Chi-square = 529.7, RMSEA = 0.074, CFI = 0.901, TLI = 0.884, SRMR = .067.

To compare the fully saturated model with the 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 the inclusion of covariance paths between selected error terms from three latent 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.

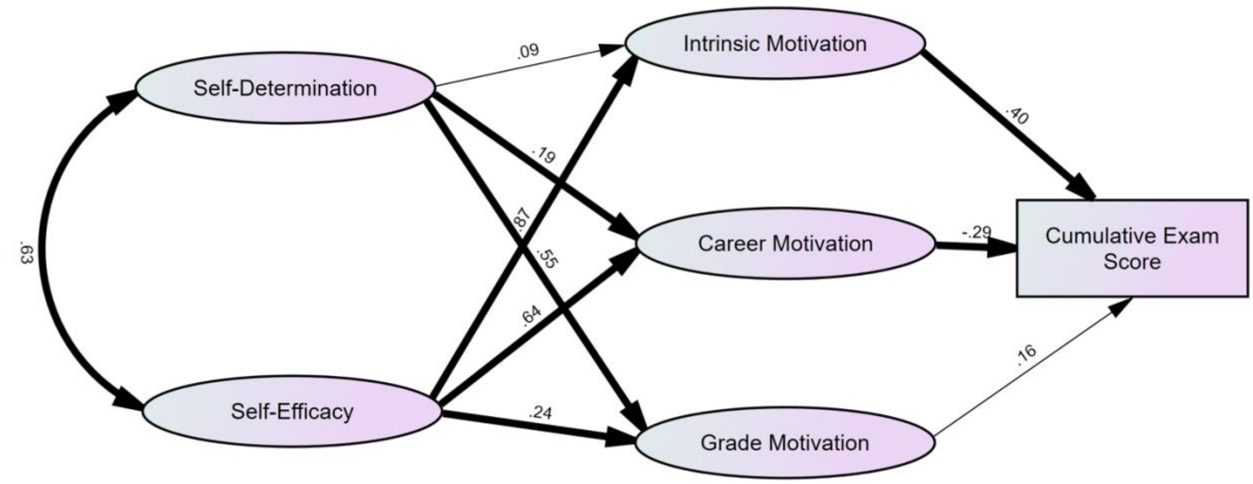

Figure 3. Alternate Structural Model – Self-Efficacy and Self-Determination as Predictors of Intrinsic, Career, and Grade Motivation

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.

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 suggests an 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 SMQ-II within collegiate aviation should do so with appropriate caution placed on the interpretation of results. 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 the 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 outcomes. 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 a 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 that translates meaningfully into academic performance. As noted above, it is also possible that multicollinearity with other latent constructs may affect the 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 a 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 from 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 a 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 the 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 the inclusion of an outcome variable reflecting performance in multiple courses. This research did not consider other backgrounds (personal factors) such as family members 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 the 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 continue 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 the inclusion of recruitment instruments that evaluate an individual’s self-efficacy prior to hiring. 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 the 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 a 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.