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## SURVEYING COLLEGIATE STUDENT PILOTS FOR THEIR PERSPECTIVES ON THEIR COLLEGIATE FLIGHT TRAINING EXPERIENCE

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Women make up roughly half of the population, but continue to be an underrepresented group in aviation. They constitute nearly 14% of student pilots, but only 8% of Federal Aviation Administration (FAA) pilot certificates, leading to a lack of understanding why a substantial number of women do not complete their training. Past diversity initiatives have not resulted in a sufficient increase in the numbers. This paper discusses a study in progress that is intended to gain perceptions of women's experiences and obstacles in collegiate flight programs using a longitudinal survey of collegiate pilots. The aim of the study is to generate guidelines on how flight programs can impact change to welcome and retain their female students. We provide a preview of the survey structure based on a thematic analysis of the literature, present metrics we will track throughout the study from the themes uncovered, and discuss survey dissemination plans.

Historically, women have been underrepresented in aviation disciplines. Among pilots, in particular, women held only 7.94% of active FAA pilot certificates in 2019. While that number has been increasing in recent years, change is slow—from 6.73% in 2010 to 7.94% in 2019. By comparison, women hold a larger portion of the active student pilot certificates—12.40% in 2010 and 13.79% in 2019 (FAA, 2020). Based on the data, a large proportion of women pilots do not complete their private pilot license. While several organizations have attempted to improve diversity in aviation in the United States overall (for example, programs such as Girls in Aviation Day), we have not investigated what makes women leave aviation, particularly at the student pilot level and at a faster rate than men. Being severely underrepresented in a male-dominated field has been shown to create challenges for women pilots, impacting their performance (Matthews, Ender, Laurence, & Rohall, 2009). Correcting the pilot shortage while improving aviation safety therefore hinges on our industry providing appropriate training and support to all stakeholders. However, the factors that impact diversity within aviation have not been sufficiently researched in recent years (Sobieralski & Hubbard, 2019).

Past research and incentives have not sufficiently corrected the disparities among women and men in the aviation industry. The literature consistently recommends we continue efforts to recruit women and other underrepresented students, but also that we monitor the status of women in those efforts (Ison, Herron, & Weiland, 2016). Through our research, we aim to identify causes of these disparities and develop guidelines which will help collegiate programs, aviation organizations, and private flight programs address them. We will use a nation-wide longitudinal survey, distributed among collegiate pilots over four years, to identify (1) any obstacles they face

that make them question their fit in the program or otherwise impact their experience, (2) perspectives on the challenges they face or they expect to face within aviation, both in their current program and in their future career, and (3) changes to individual perspectives as they navigate their collegiate program. In this paper, we discuss the literature on diversity improvement efforts and perspectives on discrimination in aviation and related industries, and identify themes and measures to further investigate. We then develop Likert-scale items to score participants on the identified measures and discuss survey design and dissemination plans.

## Literature Review

Historically, research has attempted to identify obstacles that women face in their journey towards becoming pilots, but also in their flying careers. Such studies have identified learning style, gender stereotyping, the male-dominated industry, work-life balance, and representation pressure, among others, as reasons why women either do not begin their training or do not complete their studies.

*Academic aviation curriculum design* was identified as a potential roadblock for diversity improvements in the industry in the early 2000s, when the Department of Education and the Alfred P. Sloan Foundation both funded a three-year study to maximize retention of female students (Karp, et al., 2001). The study investigated *learning style considerations* and how learning style impacts retention, and recommended that educators present their curriculum using all learning style environments, rather than relying on the traditional auditory environment. The same project resulted in a national survey of 390 pilots at nine institutions to identify the factors that influence women in collegiate aviation and found that women in the early stages of their training responded differently to the provided statements than women later on in the curriculum, while the responses of men remained unchanged (Turney, et al., 2002). Additionally, the responses of experienced women matched those of men, bringing into question the nature versus nurture debate. If we expect that women will adapt into more men-like attitudes and thought processes to survive their training, or that training will change women to think more like men, what happens to those women who are not able to adapt to the perceived mold of what a pilot resembles? Unfortunately, two decades after this important finding, there is no evidence of our academic environment changing to address different learning styles or adding a diversity component to crew resource management training.

Semi-structured interviews querying women airline pilots, based in Turkey, on their experiences in the flight deck resulted in *gender stereotyping and prejudice, male-dominated industry and industry prejudice against female pilots, discrimination from male cockpit crew, pressure of showing masculine behavior and controlling attitude, and difficulty of balancing family life* as themes that were present in their interviews (Yanıkoğlu, Kılıç, & Küçükönel, 2020). A recent phenomenological study investigating the factors that impact success among minorities in aviation identified three categories that women have talked about: *open communication, friendship and community, and positive faculty support* (Kim & Albelo, 2020).

In the literature, we also observed some flawed research methodologies that we need to avoid, both in the research described here, but also as a discipline. For example, while students are already aware that fewer women participate in collegiate aviation, as well as the airline

industry (Casebolt & Khojasteh, 2020), the disproportionate nature of the aviation population can introduce bias in direct questioning. Casebolt and Khojasteh (2020) concluded that “collegiate aviation students do not perceive that women have negative experiences at their collegiate aviation institutions because of their gender,” since 75% of students disagreed with the statement “Gender biases for female aviation students exist at my collegiate aviation institution” and 83% of students disagreed with “Gender barriers for female aviation students exist at my collegiate aviation institution.” However, the researchers also cited a sample with 96% male participation—out of 124 responses—which means that if the five women surveyed had a difference in opinion, their opinions would not be heard. Other attempts at measuring the perceptions of bias and discrimination among women did not attempt to make correlations based on demographics or compare the results to male pilots (Depperschmidt & Bliss, 2009).

### Survey Design

In this research, we are designing a survey to study perceptions of collegiate pilots of all genders as they progress through their flight training. This longitudinal study will identify if (1) pilots with varying demographics (starting by comparing populations based on gender) perceive their personal progress, struggles, and learning differently, and (2) if the students’ perceptions change over the years (i.e., if going through their program changes the way they respond to our questions). The aim of this study is to identify if there are things that flight programs, both in the collegiate and private sectors, are doing to either deter a section of the population from applying to the program or initiating their training, or discourage (or not motivate) a student, while they are in the program.

The described type of survey can introduce biases into the data which we need to be aware of. The two most relevant biases are due to the population, and due to the type of questioning. In the first case, we will minimize the potential for bias by comparing groups of people separately based on the traits we are investigating. For example, we will need to treat responses by women, men, and nonbinary pilots as different groups. We therefore do not aim to collect a dataset from a representative sample, which would result in less than 10% responses from women, but rather focus on collecting a large dataset which will allow us to break the sample into the desired groups. To address the second bias, we are identifying themes in the literature, converting them to measures, and designing our survey to measure them through indirect questioning. As a simplistic example, we would not be asking students to rate their own math skills, because they are likely unaware of the existence of concepts they do not know about, but also because they are likely to provide the answer they think we want from them or is desirable. Instead, we could ask them to rate their knowledge on specific math topics, such as algebra, differential equations, etc., or we could give them short math problems to solve so that we could measure their skills more objectively. Similarly, we cannot simply ask respondents if they experience discrimination in their program. The themes identified in the literature resulted in a list of *measures* that we want to track. Each measure is mapped to a number of *items* that will collectively assess it. For example, one of the measures identified is the feeling of *safety*. To track the safety measure, we will ask participants to indicate their agreement with statements such as “*I know how to report discrimination if needed.*” and “*I would feel comfortable with reporting discrimination.*” among others. Table 1 highlights some additional examples of measures and representative items.

The survey instrument will consist of a web-based questionnaire which will be disseminated to collegiate pilots yearly for four years, to capture any changes to perceptions and responses as students progress along their program from their freshman year to graduation, and any “generational” changes, albeit small, as new students start their programs.

### **Survey structure**

The questionnaire will consist of six sections. The respondent will (1) be introduced to the research and its importance and be provided with instructions, (2) provide the most necessary demographics (gender and school year classification), (3) respond to Likert-scale statements, and (4) provide the remaining demographic information we request. Moving most of the demographic questions to the end maximizes the amount of useful information received if the respondent does not fully complete the survey. If they respond to some or all of the Likert statements presented to them, but do not complete the demographics section, we can include their datapoints in any generalized assessment that does not make correlations based on demographic data. Additionally, the respondents will only be shown approximately half of the items for each measure, to shorten the total survey. The list of statements they see will be randomly generated. The two remaining sections will ask the respondents to volunteer more of their time if they would like to. They will first be asked (5) if they want to be considered for future focus groups or survey re-runs, or if they want to receive updates once we compile the results, in which case a separate instrument will be used to collect their contact information. Lastly, they will be asked (6) if they have a few more minutes and want to respond to more statements, in which case they will be shown the items we previously withheld.

### **Survey dissemination**

Although the response rate of web-based surveys is typically low, the number of people we will be able to reach will likely outweigh any recall and self-report biases. We will disseminate the survey through collegiate flight programs, by compiling a list of contact information for the chief flight instructor and/or academic advisor at each of the 39 (currently) AABI-accredited schools. All students, regardless of gender, will be eligible to participate. In the case of local schools, we will ask to visit the campus and introduce the survey to the students through their classes, but for more distant schools we will rely on administration to propagate how important participation is and the impact it may have. We also plan to make use of student organizations to promote survey participation, especially through organizations such as Women in Aviation student chapters and campus-based flying clubs and flight teams.

### **Theme Identification**

The aim of the survey is to investigate and report on differences in perspectives surrounding biases and obstacles that may impact women’s careers in aviation at the collegiate level. The research reviewed has not adequately identified what actions will allow women to join or stay in aviation programs. The same longitudinal study will have to be administered consistently over a period of four years to track changes as pilots advance from their freshman year to graduation, making validity in the metrics and survey design important.

To identify metrics that we should be tracking, we reviewed the literature and identified themes that the work brought up. We generated a list of 37 papers ranging from 1979 to 2020 by (1) searching online databases for papers that included the terms “*gender AND aviation*” and excluding papers that had to do purely with accident investigation, and (2) including relevant papers from the original set’s lists of references that the databases had not identified. For example, a study of pilots’ perspectives towards gender in Thai aviation (Thatchatham & Peetawan, 2020) brought up differences in *how flight instructors treat female students, women pilots having to prove their skills, perspectives on gender bias, and women adopting male behaviors*. The identified themes were then arranged in 13 metrics: *perceptions, belonging, safety, support, learning, preparation, planning, finances, community, communication, prejudices, expectations, and identity*. Examples of metrics and items are shown in Table 1.

Table 1.

*Each measure listed is described by multiple items, in the form of Likert-scale statements. The number in parenthesis refers to the number of items that currently make up the measure.*

<b>Metric (number of items)</b>	<b>Representative examples of items</b>
Perceptions (15)	Gender barriers exist for women in my program. My program is sufficiently diverse.
Belonging (17)	I sometimes feel isolated in my program. I have to prove myself to be accepted.
Safety (7)	I know how to report discrimination if needed. I would feel comfortable with reporting discrimination.
Support (9)	It is easy to find information and resources in my program. My family is excited about my career choices.
Learning (9)	It often takes me longer than others to build a skill. I spend a lot of time studying.
Preparation (4)	I prepare diligently for each flight lesson. I was sure of my decision to pursue a flying career before enrolling into my program.
Planning (6)	I am concerned about my ability to have a family as a pilot. I am confident that I will have valuable employment upon completion of my program.
Finances (4)	I have to fund my training myself. I always apply for scholarships that come my way.
Prejudices (3)	By nature, men make better pilots than women. Some jobs are better suited to people of a particular gender.
Communication (4)	I participate in class discussions. I prefer to ask questions in office hours than during class.
Community (4)	I rely on my friends for help with decisions. Most of my friends are pilots.
Identity (5)	My gender is important to my sense of identity. I think of myself as a confident person.

## Conclusion and Future Work

In this paper, we discussed the gender inequity among licensed pilots in the United States and recent literature on perspectives and reasoning for the imbalance. Through the literature, we identified common themes for the biases and barriers that women have mentioned in the past, and converted them to measures that we want to track in the future. We designed a survey around these measures that consists of Likert-scale statements and demographic information. The survey

will be distributed to all collegiate pilots, regardless of gender, in a longitudinal study that aims to investigate differences in perceptions among genders, but also any potential differences in perceptions over time, as these pilots progress through their programs.

We expect to distribute the survey to collegiate programs in late August 2021 as students are starting their academic year by contacting academic advisors and chief flight instructors, as well as campus-based flying clubs and aviation organizations which interact with our population of interest. We hope to get approximately 300 responses from the first run of the survey. This year's survey will help us establish a baseline understanding of perceptions of our student body so that we can start forming guidelines for diversity policies and initiatives. We will run the same survey yearly to track students' perceptions as they advance in their schooling and training and report our results in future publications.

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