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**A Literature Review
of Aviation Diversity**
pg. 6



about the council

ATEC was founded in 1961. Its mission is to promote and support aviation maintenance technical education.

The council actively engages with regulatory and legislative bodies to advocate on behalf of the community, and provides resources, continuing education, and networking opportunities for our members.

Our membership is made up of employers, vendors, and educational institutions with aviation technical programs. The vast majority of member schools are certificated by the FAA to provide aviation mechanic programs.

Membership supports the following activities and initiatives—

- Advocating for sound regulatory policy, the development of clear and concise guidance, and consistent enforcement and application
- Participating on industry and agency committees to further aviation technical education and workforce development
- Fostering and supporting career pipeline partnerships between industry and educational institutions
- Facilitating networking opportunities through the annual conference, Washington fly-in, regional outreach meetings, and virtual webinars
- Enhancing aviation technical career awareness through support of ATEC's sister organization, Choose Aerospace

about the journal

The *ATEC Journal* (ISSN 1068-5901) is a peer-reviewed, biannual electronic publication. The publication provides an opportunity for educators, administrators, students and industry personnel to share teaching techniques and research. Authors are encouraged to submit their articles for publication consideration, whether scholarly, research, application, or opinion, by using the submission form below. Papers supporting the council's regulatory and legislative agenda may be considered for presentation via online webinar and at the annual conference. Suggested topics include:

- Technical and soft-skills curriculum integration
- A history of legislative actions affecting aviation maintenance workforce development
- A study on implementing employer-education partnerships
- Funding implications stemming from Bureau of Labor Statistics occupational outlooks
- Highlighted innovations in the aviation maintenance industry
- A look at successful online teaching methods and subject matter in other technical fields
- Surveying currently used computer-based teaching across aviation maintenance training schools

SUBMISSION DEADLINES

Fall Issue Closing Date: October 1 • Spring Issue Closing Date: May 1

SUBMIT AN ARTICLE FOR REVIEW AT ATEC-AMT.ORG/THE-JOURNAL.HTML



from the EDITOR

In this issue, Carlos Smith and his colleagues at Middle Tennessee State University discuss findings from a literature review of past research involving diversity in the aviation industry and how these results may be useful for guiding future research efforts. Their work will certainly be useful to others who are working to advance awareness and action in diversity, equity, and inclusion.

As we approach the new year, the ATEC Editorial Board would like to express our sincerest wishes to all of our colleagues across the AMTS community to enjoy a happy and safe holiday season. We look forward to continuing our work to bring you more insights to the ongoing research happening across our schools in the new year.

Sincerely,

Karen Jo Johnson, Ph.D.

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COMMITTEE UPDATES

Committee membership is open to all individuals employed at ATEC member companies. Explore what the trade association is doing and pledge to get involved in the new year. Committees will hold in-person meetings at the upcoming ATEC Annual Conference. After you check in, plan to join us from 2-4:30 on March 26 at the Hyatt Centric.

MEETING PLANNING COMMITTEE

We can't wait to see you in Chicago! The annual conference, sponsored by United Airlines and hosted by the Aviation Institute of Maintenance, will take place March 26-29. Look for a full agenda to publish early in the new year, which will include FAA briefings, AMTS best practices, employer feedback, and tips for the classroom. As always, we'll have opportunity to network with vendors, employers, and fellow A&P schools, all with a little bit of Chicago flair.

If you have not already, we encourage you to sponsor, exhibit, and register at atec-amt.org/2022-annual-conference.

All our employer partners are encouraged to sign up to participate in the Employer Link, taking place on March 28. More information available at <https://www.atec-amt.org/employer-link.html>.



NICHOLE GLEATON
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MEMBERSHIP COMMITTEE

The trade association continues to grow its membership, again—for the seventh year running—breaking previous records with record high numbers. Four out of every five part 147 programs are members of the ATEC community, a market share that is virtually unheard of in the world of trade associations.

As the new membership chair, I commit to helping further expand our community to include every FAA-certificated program, every employer we serve, and every high school and community-based program that feeds us students. And as always, the committee will continue to identify ways to best serve our membership through resources, webinars, education, and networking.

If you have not already, we hope you will renew your membership in 2023. Dues invoices were delivered in October so please reach out to double check your organization's primary contact if you have not seen it. Membership packages will come to your mailbox in January, including a special resource in celebration of the new part 147. We hope you use it early and often!



JAMES SMITH
**MEMBERSHIP
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REGULATORY COMMITTEE

The regulatory committee is acutely focused on providing continued resources to the part 147 community as it embarks on new initiatives under a much improved regulatory framework. Between May and September of this year, ATEC hosted nine webinars in partnership with FAA officials to ensure the community was educated on the new rule. Resources were developed to help programs request new operations specifications and to align curriculum with new airman certification standards. Much credit is given to our partners at the FAA who worked in partnership with the council to ensure a smooth transition.

The committee's attention is now shifting to implementation of the airman certification standards as the new testing standard, and necessary updates to FAA guidance and handbooks. And now that the ACS is in place, the council will ensure it is an active and engaged participant in the ongoing revisions that will drive both training and testing. Follow that initiative and other regulatory priorities at <https://www.atec-amt.org/regulatory>.



SEAN GALLAGAN
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CHOOSE AEROSPACE

The Choose Aerospace aviation maintenance general curriculum embarked on its inaugural year this spring, with 200 students expected to enroll this academic year. We are grateful to the ATEC community for its support of this new and exciting opportunity, including the board's pledge to support high school teacher training and ways to ensure students have access to certification pathways earlier in the training cycle.

Our A&P programs are catching wind of this exciting program and finding creative and innovative ways to implement it to increase awareness in their communities and grow the number of students enrolled. If you are not familiar with the Choose Aerospace aviation maintenance curriculum, I encourage you to visit our website and/or reach out to schedule a briefing on how it can create new pipelines to mechanic certification.

Applications are open to adopt the curriculum for the 2023-2024 academic year. Learn more at chooseaerospace.org/curriculum.



RYAN GOERTZEN
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LEGISLATIVE COMMITTEE

The legislative committee was the community's watchdog after the new part 147 was promulgated in September. Members oversaw implementation and kept in close contact with our congressional champions to ensure the rule was aligned to Congress' intent. The September Fly-in provided us the opportunity to visit and thank 45 members of Congress for their leadership and support of aviation technician education.

With a new rule in place, and a relatively "easy" transition, the committee is refining its legislative priorities in preparation for FAA reauthorization. An ongoing list of what we're focused on is available at <https://www.atec-amt.org/legislative>.

Mark your calendar for next year's ATEC Fly-in, scheduled for Sept. 19-22, 2023.



JARED BRITT
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A Literature Review of Aviation Diversity

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ABSTRACT

It is well known that there continues to be a lack of diversity in the fields of science, technology, engineering, and mathematics (STEM). Data from the Bureau of Labor Statistics (BLS) documents very little growth in the number of women and minorities working in many of these fields. The field of aviation is considered to be a STEM field and shares the same lack of diversity. The BLS publishes data on the number of aircraft pilots, flight engineers, aircraft mechanics, and service technicians. According to the 2021 data, women accounted for only 5.3% of all aircraft pilots and flight engineers. In addition, only 3.9% of all aircraft pilots and flight engineers were Black, 1.5% were Asian, and 6.1% were Hispanic or Latino. The majority of aircraft pilots and flight engineers were White males. The data for aircraft mechanics and service technicians was similar. According to the 2021 BLS data, only 3.2% of all aircraft mechanics and service technicians were women, 5.7% were Black, 4.2% were Asian, and 15.3% were Hispanic or Latino. In comparison, out of the total number of employed persons aged 16 and older in the United States, 47% were women, 9.8% were Black, 9% were Asian, 18% were Hispanic or Latino, and 77.5% were White (BLS, 2021). The goal of this literature review is to survey the existing research on diversity in the aviation industry to identify what has been discovered and what has been recommended as a baseline for future research.

Commercial aviation is a White-male-dominated industry. While the industry has made progress in the last half century since the passage of the Civil Rights Act of 1964, the growth in the number of women and minorities working in the aviation industry has been quite slow. The participation rate of women and minorities in highly paid aviation occupations is very low compared to the total number of women and minorities in the workforce. Progress has been made with the help of organizations such as the Organization of Black Aerospace Professionals (OBAP), Women in Aviation International (WAI), Latino Pilot Association (LPA), and the Professional Asian Pilot Association (PAPA), but participation of these groups in the aviation industry remains low. While research to determine what is behind this persistent problem has increased in the last two decades, there has been very few comprehensive reviews of this research to summarize common conclusions and recommendations. This literature review focuses on research attempts in the last two decades to determine why the number of women and minorities in the aviation industry remains low.

WOMEN IN COMMERCIAL AVIATION

Focusing solely on the low representation of females in the professional pilot industry, there is a common theme throughout the existing literature. Two factors that affect the recruitment, selection, and retention of female pilots are cultural barriers and gender bias. With early military aviation influences, there was and has been a portrayal of the typical pilot as predominantly masculine. Both physical and cultural traits have been male dominated since the early days of the Wright Brothers in 1903 to the current 2022 climate with approximately 6% females in the aviation industry.

Casebolt and Khojasteh (2020) surveyed 124 undergraduate students, and their research revealed that many felt there are fewer women in aviation than men due to the history of aviation being male-dominated and societal views as to what are traditionally acceptable female career paths. The hegemonic masculinity of aviation is undeniable, and research suggests the larger societal gender biases and cultural barriers against females must be resolved before the inner cultural changes will occur within the aviation industry (Gorlin & Bridges, 2021). In other words, the bigger issue must be fixed before we can tackle the lack of inclusion and diversity within the aviation industry.

Women have learned to adapt to male traits and attitudes to be successful as pilots in the flight deck (Turney et al., 2002). This adaptive process can add stress to these females above the stress that comes from the nature of the job. These stressors include harassment, gender bullying, and gender bias policies (Gorlin & Bridges, 2021). This is a temporary solution. To elicit substantial improvements in recruitment and retention of females in aviation, the culture of aviation must adapt, not the individuals adapting to barriers and biases. These barriers are both conscious and unconscious (Gorlin & Bridges, 2021).

Many studies that have focused on the number of women in different aviation fields and why we are not attracting and retaining women in these fields. Stevenson et al. (2021) noted:

Historically, gender bias in the workplace has contributed to perpetuating structural inequalities. Particularly, elements such as professional growth, monetary benefits, the role of management, and job satisfaction were identified as areas of interest affecting retention of women in the aviation workplace when the Aviation Occupation Survey was developed. (Stevenson et al., 2021, p. 2)

According to Stamarski and Hing (2015), human resource policies can be biased against a group of people regardless of abilities, skills, and knowledge. Essentially, hiring practices and policies for fields such as the aviation industry can be inherently biased against a particular group, e.g., women (Stevenson et al., 2021). Stamarski and Hing (2015) noted the following:

... if women are underrepresented in a particular educational program or a particular job type, and those credentials or previous job experience are required for selection, women are being systematically, albeit perhaps not intentionally, discriminated against (p. 3).

The Aviation Occupation Survey was designed by Stevenson et al. (2021) to research the question about the factors that might contribute to women's retention in aviation occupations in the United States. Individuals were asked about perceptions of their workplace, job satisfaction, work-life balance, and gender bias in the workplace. A total of 188 participants (70 women and 118 men) participated in the survey. Results revealed similarities in the men and women when

it came to numerous aspects of their workplace like job satisfaction and growth opportunities. Results revealed that the female participants had reported significantly greater concerns for sexual harassment and gender bias in the workplace. Although bringing more women into the industry is an important factor to seeing the numbers grow, retaining the women that are already in the industry is arguably more important. Stakeholders and business owners alike must "work together to identify viable solutions to restructure the system to accelerate gender parity and create a safe work environment open to all employees regardless of gender" (Stevenson et al., 2021, p. 19).

Over the past several decades, we have seen the growth of women in postsecondary education. Historically however, there has been a lag in women participating in subjects such as science, technology, engineering, and mathematics (STEM). Significant effort has also been put forth to raise the number of women and minorities in the STEM fields (Ison, 2010). Unfortunately, little research exists that investigates whether there has been any improvement in the quantity of women moving through the aviation industry supply pipeline, i.e., aviation higher education. This lack of complete and current data exists for all aspects of participation by women in postsecondary aviation.

Ison (2010) sought to quantify the historical number of women students who had completed a collegiate aviation baccalaureate degree program, the number of women in aviation faculty positions, and the number women in academic leadership positions in aviation programs. It was found that within the past decade, the number of women students participating in aviation higher education has grown from 10.8% in 1995, to 11.7% in 2005 (Ison, 2010, p. 5). Unfortunately, there has not been the same growth seen for women among aviation faculty: "Research shows that improved participation of women among aviation faculty is critical to the support of fellow women in aviation higher education" (Ison, 2010, p. 6). According to Ison, past research has found that higher confidence was reported by women aviation students and better educational experiences when students have access to a woman faculty member (Ison, 2010).

The study that Ison (2010) conducted sought to quantify four different areas: The first being the historical number of women students who have completed a baccalaureate degree in collegiate aviation, the second was the number of women in aviation faculty positions for comparison to the numbers found in prior research, the third was the number of women academic leaders, and fourth was baseline data for future studies in this area. The results of this study found some stable participation rates for women with only some fluctuation from year to year. However, there were no statistically significant differences found.

It is no secret that the way men and women learn, lead, and communicate can be vastly different. These differences have been identified in many studies. Turney (2018) found that, "women learn in a cooperative, collaborative manner, often through conversation and sharing of ideas. Men prefer competition and debate and frequently

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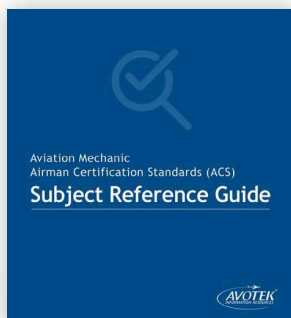
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learn in a more autonomous style” (p. 1). In contrast, “men wish to make important contributions, seek challenges, and exhibit a pattern of casual interaction with people in the workplace” (Turney, 2018, p. 1). Women tend to be told “war stories” that communicate messages of unwelcomeness or the hardships they are going to face if they continue in technical types of industries. While aviation in general lacks the ability to retain women, there is also a unique problem in that women are not prepared for aviation careers like men are in their early childhood years. Little girls are taught and engage in games that prepare them with skills for staying home and raising families (e.g., dolls, playing house, dress up). Little boys are taught and engage in games that prepare them for the social skills required for careers. According to research cited by Turney (2018), the following differences between men and women were found to be factors that flight instructors should consider when teaching women pilot trainees (Turney, 2018, p. 4):

1. Women are slower to gain confidence in the airplane.
2. Women require more flight hours before initial solo flights.
3. Women are more fearful of stalls, spins, and unusual attitudes.
4. Women are slower to grasp aerodynamics.
5. Women are quicker to grasp instrument flight.
6. Once women learn a procedure, they rarely vary it.
7. Women handle aircraft controls more smoothly.
8. Women have far fewer accidents in airplanes than men.

The author concluded that male flight instructors who understand the differences in learning styles between men and women could use this knowledge to support the success of women pilots and prevent them from dropping out of flight training. The atmosphere of the industry must be changed to stop the “weed out” type methods and war stories that scare women away from careers in aviation (Turney, 2018).

BLACK COMMERCIAL PILOT EXPERIENCE

Evans and Feagin (2012) explored the experiences of Black Americans who work as professional pilots by looking at in-depth interviews to see if systemic racism and marginalization is still an issue in the predominantly White aviation industry. As more Black Americans enter the middle class, many have argued that race is no longer an issue. However, this argument does not consider the experience of Black Americans in White-dominated industries such as aviation. Before civil rights legislation in the 1960s, Black Americans were excluded from participation in many different industries and professions. After passage of the Civil Rights Act in 1964, Black Americans began to seek employment in these previously out-of-reach occupations. Many media outlets cite this progress as proof that racism is no longer a problem in the United States, but this viewpoint ignores the lived experience of many Black Americans in the workplace. People of color often must contend with racist and discriminatory behavior from their managers and co-workers.

As a result of the Civil Rights Act of 1964, the number of Black middle-class Americans has increased, and their success has perpetuated an erroneous perception that racism is a thing of the past. This misperception hides the real pain felt by many Black Americans. By asking Black pilots who work in commercial aviation about their recent experiences, the authors sought to demonstrate that racism is still a very real problem in the United States.

To explore recent experiences of Black pilots, the authors focused on four interviews that took place between 2010 and 2011 during a study of Black men and women pilots working in the airline industry. While significant research exists concerning gender in the aviation industry, very little literature exists about the experience of Black pilots according to Evans and Feagin (2012). Because airline pilots experience in the workplace is unique given that they are frequently secluded in the flight deck with White employees, the authors stated that the lack of research is unfortunate. In addition to Black pilots’ experiences with coworkers, passenger experiences were explored because of the limited exposure of Black pilots to the White public.

Examples of discriminatory behavior encountered by Black pilots were numerous. While there are laws protecting Black pilots from discriminatory employment practices, they still encounter subtle behavior in the workplace that is experienced as prejudice or racist. Although it cannot be characterized as overt, the behavior encountered is still considered to be racist by the Black pilots who must endure it. One example given was the experience of two Black pilot trainees during their initial ground and simulator training. It was not overt, but the behavior of the instructor assigned to these two Black pilots was such that it made them question what was happening. The instructor eventually admitted that he was not expecting to see two Black pilots, and they were the first Black pilots that he had ever been assigned to train. The Black pilots’ suspicion that they were being patronized was confirmed when the instructor admitted that he didn’t know whether he should “lower the bar” for them to make sure they were successful. The authors cited this as a significant example of the persistent prejudice that Black workers face daily. This behavior is not isolated and occurs to Black pilots regardless of their level of experience and education.

Evans and Feagin (2012) concluded that White racism is not an abstraction. It occurs regularly and is viewed as ordinary experience by many Black pilots. The authors’ recommendations included significant new research to look at how Black pilots deal with subtle racial discrimination daily and regularly.

In a study by Stevenson, et al. (2020), data from the American Community Survey was analyzed using the United States (US) Census Bureau Public Use Microdata Sample (PUMS). The authors examined employment trends from 2009 to 2018. The statistics from five major aviation industry occupations were compared (aircraft pilot and flight engineer, aircraft mechanic and service technician, air traffic controller and airfield operations specialist, aerospace engineer, and avionics technician). The authors also selected four specialized

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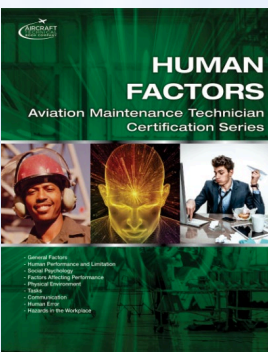
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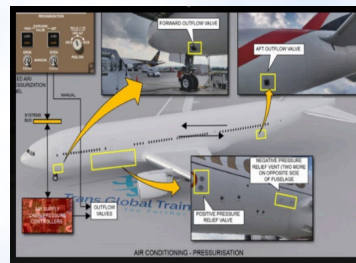
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training professions to compare to aircraft pilots (actuary; physician; mechanical engineer; and lawyer, judge, or magistrate). Data analysis was conducted on comparing the percentage change in White pilots and Black pilots over the same 10-year period.

All five aviation occupations were predominantly White during the 10-year period (Stevenson et al., 2020). The data range for Whites was from 72.2% to 95.3%, and the range for Blacks was between 1.6% and 13.1%. The lowest percentage of Blacks (1.6% to 3.4%) was in the aircraft pilot and flight engineer occupation. The highest percentage (6.56% to 13.1%) was in the air traffic controller and airfield operations specialist occupation. The largest number of Blacks were employed in the aviation mechanic and service technician occupation category (14,395 to 22,050 or 7.3% to 10.6%).

Stevenson et al. (2020) analyzed the data for the four specialized training professions in the same 10-year period. Again, the predominant race in all four occupational categories was White (69.7% to 95.3%). Blacks accounted for the lowest numbers (0.6% to 5.7%). The actuary profession accounted for the lowest percentage of Blacks (0.6% to 3.5%) which was comparable to the aircraft pilot and flight engineer occupation category (1.6% to 3.4%). The largest percentage of Blacks were in the lawyer, judge and magistrate and the physician occupation categories (4.6% to 5.7% and 4.5% to 5.5% respectively). The largest number of Blacks in the 10-year period were employed in the lawyer, judge, and magistrate occupation category (52,980 to 73,098).

When looking at the percent change over the 10-year period, the percentage of White pilots was relatively consistent compared to the percentage of Black pilots. “Figure 1, from Stevenson et al. (2020, p. 13), illustrates the differences.”

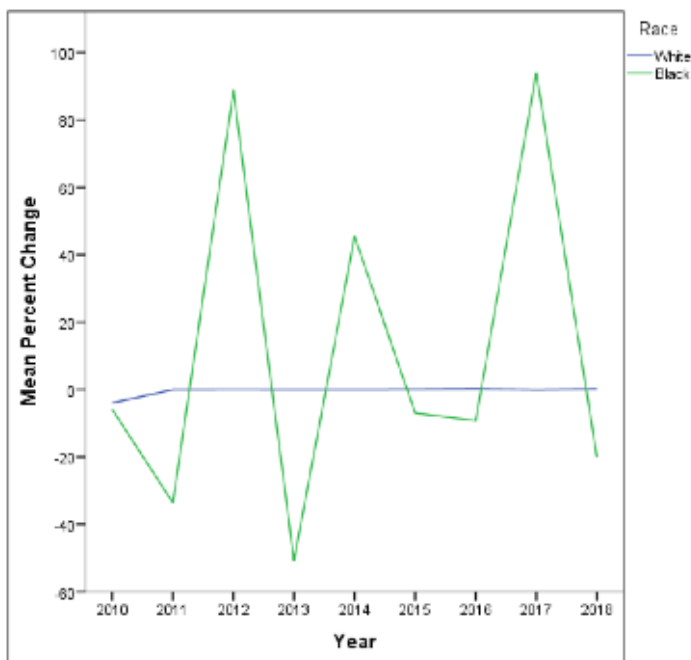


Figure 1. Percent of Aircraft Pilots and Flight Engineers by Race from 2010 to 2018

Stevenson et al. (2020) stated that the study results demonstrated a potential resource that has been ignored as a solution to the aviation industry labor shortage. While it is a complicated issue, the authors recommended that both public and private stakeholders should cooperate to develop strategies for recruiting and retaining more minorities to increase racial diversity in the aviation industry.

AVIATION MAINTENANCE DIVERSITY

Clark et al. (2015) did a mixed-methods concurrent triangulation study to determine why women choose aviation maintenance careers. The researchers asked 431 women to complete a survey with thirteen 5-point Likert and open-ended questions. Quantitative analysis revealed that there was a relationship between the perception of physical limitations, career appropriateness, safety, social acceptance, and opportunities of advancement. A qualitative analysis revealed that women lack knowledge about the field of aviation maintenance and that women feel that they would be subject to sexual discrimination in this field. In addition, the researchers asked the participants if marriage or motherhood were factors in the decision to pursue a career in aviation maintenance. An independent-samples t test was not significant $t(429) = -.525, p = .60$ supporting the research null hypothesis that marriage was not a factor. Another independent-samples t test was not significant for motherhood as a factor $t(429) = -.439, p = .66$. Clark et al. (2015) concluded that women lack knowledge about the field of aviation maintenance, but those who felt it is an appropriate career choice for women were associated or knew of a woman in the field. They recommended improving communication to make the career more attractive to women.

Newcomer et al. (2018) did a follow-on mixed-methods study to explore the male perspective concerning women in the aviation maintenance field to see if the perceptions of men differed from the perceptions of women found in a previous study by Clark et al. (2015). A survey with eight questions was answered by 587 men. The survey consisted of 5-point Likert scale and open-ended questions. The purpose of this study was to determine whether men feel that aviation maintenance is an appropriate career for women and whether men exhibit gender or ability bias that might prevent women from entering the field. The results of this study revealed that men are significantly more positive about advancement opportunities, absence of physical limitations, safe working environment, and social acceptance of women working in the aviation maintenance field. Clark et al. (2015) found that most women felt unsure or had a negative impression about opportunities in the aviation maintenance field. Women also differed significantly on perceptions of social acceptance which might explain why so few pursue a career in aviation maintenance. Newcomer et al. (2018) concluded that social acceptance was key to understanding why the perceptions of men and women were significantly different. It is human nature to seek social acceptance and avoid social rejection. The researchers concluded that women will not pursue careers in aviation maintenance until it is perceived as socially acceptable, and the first step to changing this perception is education.

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Rouscher (2021) looked at practices employed by STEM fields to recruit and retain women to determine whether they might also encourage more women to pursue careers in the aviation maintenance field. Although the number of women working in aviation maintenance has increased in the past decade, the participation rate has not changed significantly. Due to the forecasted shortage of aviation maintenance technicians (AMTs), it is critical to examine how other fields have attracted women to careers in STEM to determine whether these practices might increase the number of women AMTs. Engineering is a field that has traditionally been dominated by men. As such, anyone who doesn't fit in may be subject to overt and subtle discrimination. What has repeatedly been shown to work to retain women in engineering is mentoring. Mentors can assist women engineers and provide guidance and encouragement. Mentors can help women engineers make positive connections to other women in the field of engineering which will lead to a sense of social acceptance and increased self-confidence.

COLLEGIATE AVIATION DIVERSITY

In 2013, there were 6,994 women in the United States who held an Airline Transport Pilot (ATP) certificate. An ATP is required to work as a pilot for a scheduled airline under Title 14 of the Code of Federal Regulations (CFR), Part 121. Of the 6,994 women ATPs, fewer than

20 were Black (Evans, 2013, as cited by Morrison, 2019). The Federal Aviation Administration (FAA) does not collect data on the number of ATPs who are Black, Asian, Latino, Indigenous, or LGBTQ+, but not many of these groups are represented. According to Morrison (2019), the low number of women and minorities working in the aviation industry is indicative of a serious underlying problem. Because of the looming shortage of qualified airline pilots and the growing emphasis on diversity and inclusion in the workplace, interest is growing in the aviation industry to find ways to recruit and retain women and minorities into aviation careers according to the author. To address the question about why the number of women and minorities working as professional pilots has been persistently low, the author looked at collegiate diversity programs that are designed to recruit and retain underrepresented students into the fields of STEM.

The main research question for Morrison (2019) focused on whether these collegiate diversity and inclusion programs influenced students to persist in an aviation degree program. To answer this question, the author looked at diversity programming and how this programming interacts with other influences such as campus resources, affordability, career opportunities, and adverse life conditions. The author felt that addressing these other variables would paint a more complete picture of the effects of these diversity programs. A survey was administered to a group of 75 women and minority aviation students.

The null hypothesis for this study was the following:

H₁: Women and minority students who are exposed to diversity and inclusion policies are more likely to remain in the aviation program.

The goal of this research was to measure the relationship between diversity and inclusion policies on student retention in aviation programs. However, another important goal was to determine how other factors interact to influence a student to remain in an aviation program. Therefore, a logistic regression test was employed that would analyze how these other variables interacted with diversity and inclusion policies and programs. The analysis of the data did not establish a statistically significant connection between the consideration of leaving the aviation program and exposure to diversity policies. However, the author's preliminary results did suggest that students who are more likely to be exposed to diversity policies are less likely to leave the aviation program. The author concluded that a larger sample size would be required to obtain statistically significant results (Morrison, 2019).

Although this data failed to establish a statistically significant connection between diversity policies and retention in an aviation program, it did support previous research findings that multiple variables influence a student's decision to leave an aviation program. Many of the variables considered in this research were highly correlated with retention, which supports the conclusion that diversity and inclusion policies will work only when the student's total collegiate experience is considered.

Ison et al. (2016) looked at data from the Integrated Postsecondary Education Data System (IPEDS) to determine enrollment trends in collegiate aviation programs to see if any growth occurred in minorities enrolled in professional pilot programs. Until recently, the United States population was predominantly White, but the number of Blacks, Asians, and Hispanics has been increasing steadily over the past three decades. The author cited data from the U.S. Census in 2007 that showed the minority population was more than 100 million or about one-third of the total population in the United States.

According to the U.S. Department of Labor, by the year 2050, the minority population in the United States should be 50 percent of the total population. These demographic changes have led to dramatic enrollment changes in higher education. The number of minority students enrolled in higher education has grown faster than the number of White students according to research cited by Ison et al. (2016). Even so, the number of minority students enrolled in STEM fields has been low compared to the number of White students.

Although looking at historical data is important to determine past trends, the author elected to look at data concerning the number of women and minorities currently preparing for careers as professional pilots to estimate future growth. Data from the IPEDS was analyzed focusing on students enrolled in collegiate aviation programs. IPEDS data from 2004 to 2014 was extracted to produce the total number of collegiate aviation students who graduated with associate, bachelor's, and master's degrees in professional pilot degree programs.

Ison et al. (2016) performed a Chi square goodness-of-fit test with expected frequencies based on the student distribution in the years from 2004 to 2014. The results indicated a significant increase from 17.1% to 22.2% in minority professional pilot students which included women. This change was determined to be statistically significant ($z = 3.7, p < 0.001$). The participation rate of non-White professional pilot students increased from 17.3% to 27.3% in the same period. That finding was also statistically significant ($z = 2.0, p = 0.04$). When the groups were analyzed separately, Hispanics (including men and women) were the only group that increased significantly. The participation rate of women (all races) decreased by 1%, and Native American participation decreased slightly. The author collected data from 1997 to determine the change in participation over a longer period. Minority participation (including women) increased from 16.5% to 22.2% which was statistically significant ($z = 3.7, p < .001$).

In the discussion, Ison et al. (2016) compared these results to the current estimated participation rate of women who work as professional pilots as well as the estimated participation rate of minorities in the profession. According to the authors, an estimated 4.3% to 6.7% of professional pilots are women and 18.4% are members of a minority group compared to 8.6% women and 27.3% minorities who participate in collegiate aviation programs. The authors stated that this is an encouraging result if these professional pilot students eventually become employed as professional pilots. While Hispanics and Asians accounted for most of the growth between 2004 and 2014, there were significant increases in all minority groups dating back to 1997. While this is encouraging, the authors stated that participation rates of minorities and women in collegiate aviation programs is still well below overall participation rates in higher education.

DIVERSITY EFFORTS IN THE AVIATION INDUSTRY

Aviation companies have made many initiatives to increase the number of women and minorities in the aviation industry. However, according to the FAA (2021, 31 December), the number of women and minorities remains low. The aviation industry commonly campaigns around the months observed by each minority group (e.g., Black History Month) to encourage more women and minorities to enter the field of aviation. According to Morrison (2021) these promotional campaigns make the aviation industry appear to be supportive of diversity and inclusion without making real changes that might eliminate or at least reduce the barriers to employment of women and minorities in highly paid aviation careers. These promotional campaigns have been characterized as window dressing according to Morrison (2021) and most do not result in any significant change. These companies simply put a bandage over the situation and say that it is fixed.

Black pilots and flight attendants were found to suffer from something called emotional labor (Evans, 2013, as cited by Morrison, 2021). Even with marketing efforts around affinity months, Black workers still face the challenges of discrimination. As much as com-



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panies try to address diversity, equity, and inclusion in the workplace, efforts seem in vain given these experiences. Morrison (Evans, 2013, as cited by Morrison, 2021) quotes Evans by stating, “diversity, as defined in theory and practice, are not synonymous with equality” (p. 6). Some argue that diversity efforts serve to protect only the whiteness and male domination of the industry, and no matter how hard we try to make efforts toward equality, there will always be those in the industry who feel Blacks just do not belong (Morrison, 2021).

CONCLUSIONS

Many common themes emerge in the literature concerning women and minorities in the aviation industry. Although the literature recognized that recruiting more women and minorities to enroll in collegiate aviation programs is important, the research also acknowledged the need for more systemic change. In other words, participation rates of women and minorities in collegiate aviation programs and the aviation industry will not significantly increase without a change in culture. As described by Gorlin and Bridges (2021), the aviation industry suffers from a culture based on militarism and a patriarchal belief system, that has been aided by popular culture. Overt racism has been reduced by legislation, but subtle racism in the workplace is a common occurrence for Black pilots according to Evans and Feagin (2012). Morrison (2021) called this emotional labor based on gender and racial identity.

Although some data is encouraging and shows an increase in the participation rate of women and minorities in collegiate aviation programs (Ison, 2016), it is much higher than the participation rate of women and minorities working in aviation professions. This is cause for both concern and optimism. It is cause for optimism if the relatively high rate of women and minorities in the training pipeline leads to an increase in the number of women and minorities working in the aviation industry as they begin to filter into the workforce. It will be cause for concern if the number of women and minorities working in aviation occupations does not increase over time.

Inequality between men and women is complex because it is influenced by many different factors. Stamarski and Hing (2015) found that organizational structures, processes, and practices can have a dramatic effect on individual behavior. According to the authors, focusing on reducing gender bias in individuals alone without addressing institutional discrimination is not the best way to reduce gender-based inequality. Gender inequality is evident in many human resource practices and policies on hiring, training, compensation, and promotion. Decision makers in these organizations play a critical role in gender discrimination.

RECOMMENDATIONS

Both public and private organizations must work together to implement effective recruitment and retention strategies as well as policies that are designed to promote gender and racial diversity in the aviation industry. A significant, untapped labor source exists that could help to resolve the labor shortage in the aviation industry.

Systems must be restructured to accelerate racial and gender parity. Organizational structures, processes, and practices that communicate the importance of racial and gender equality will constrain discriminatory behavior. Therefore, organizations should work to reduce institutional discrimination by focusing on these organizational structures, processes, and practices rather than focusing on changing discriminatory behavior of individual employees.

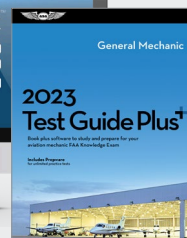
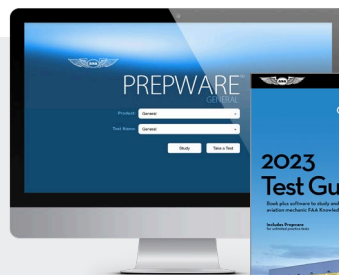
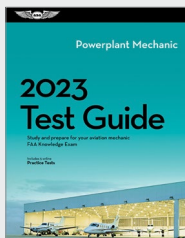
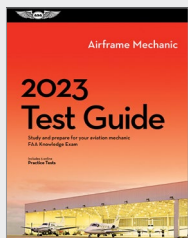
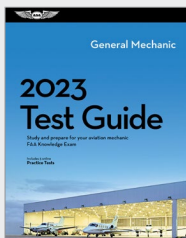
More research is needed to understand how racial and gender discrimination affects the everyday experience of women and minorities working in the aviation industry. A better understanding of the consequences of racial discrimination and other racism encountered by minorities in the aviation workplace is needed to create lasting change. Focusing only on increasing the number of women and minorities in aviation does not address the everyday challenges faced by these groups. Developing an understanding of these experiences will help us understand the reasons behind the low participation rate of women and minorities in the aviation industry.



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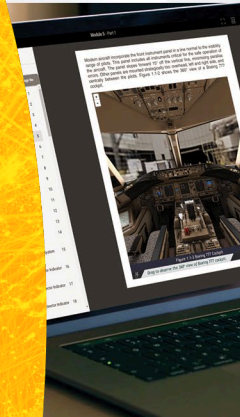
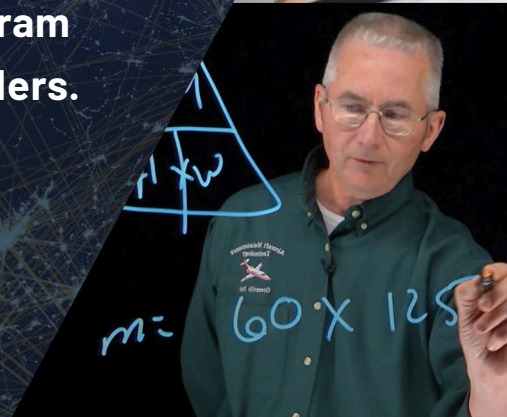
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