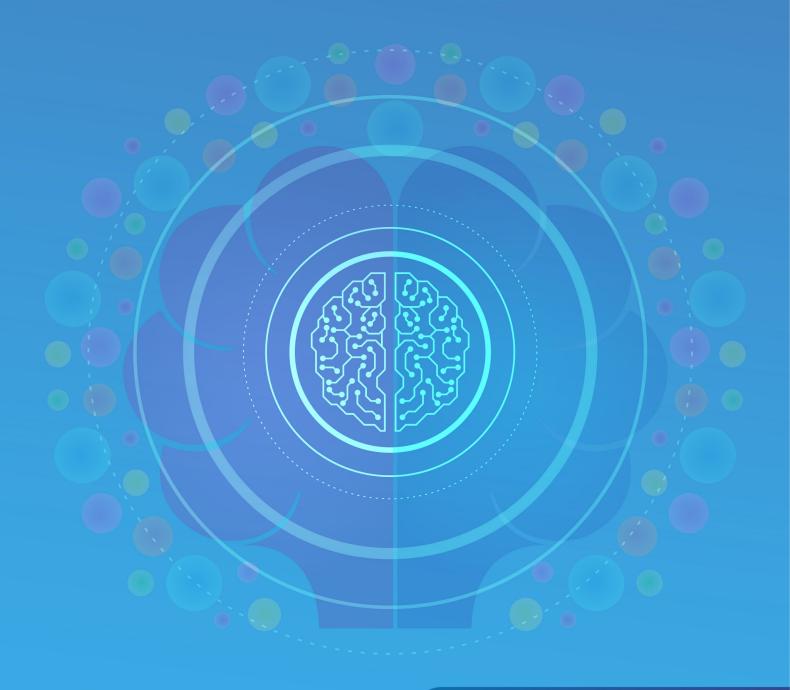


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Exploring Gender Diversity in Aviation Education: A Comprehensive Review of Challenges, Initiatives, and the Path Forward

Jonah Gonzalo^{1*}, Ma. Theresa Dumdumaya¹, Shella Fanoga¹

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ABSTRACT

Gender diversity in aviation education has long been a significant issue for the aviation industry. This review investigates gender diversity by analyzing historical participation, key barriers, and initiatives to promote inclusivity. Using a systematic approach, academic databases such as Google Scholar, JSTOR, ResearchGate, Scholarly Commons, Academia. edu, and specialized aviation industry sources were searched. Peer-reviewed articles published within the last 10 years were selected based on inclusion criteria, including relevance to aviation education and gender diversity. A thematic analysis was performed to identify significant gaps, key challenges, initiatives and outcomes to assess the current state of gender diversity in the field. This review highlights the need for comprehensive efforts to create a more inclusive educational environment to close the gender gap in aviation education and improve the industry's overall sustainability.

INTRODUCTION

Gender diversity in aviation education has long been a significant issue within the aviation industry. Historically, this field has been predominantly male, with women encountering considerable barriers to entry and career advancement (Marete *et al.*, 2022 & Turner, 2022). In recent decades, however, there has been a growing awareness of the need to address this gender imbalance and encourage greater participation of women in aviation education and careers.

The underrepresentation of women in aviation education is a critical issue that warrants thorough investigation. Data from the Organization for Economic Co-operation and Development (OECD) reveals that only 12% of students in aviation-related tertiary education programs are women. This stark statistic highlights the significant gender gap that still exists within the aviation education pipeline. Addressing this disparity is essential not only for reasons of equity and social justice but also because it has substantial implications for the future development and sustainability of the aviation industry.

The significance of promoting gender diversity in aviation education is profound. A more diverse and inclusive educational setting can contribute to greater innovation, more effective decision-making, and enhanced problemsolving abilities within the industry (Lythe, 2024; Walsh, 2024). When a wider range of perspectives and experiences is represented, the aviation sector is better equipped to meet the evolving demands of a diverse global clientele (Walsh, 2024; Seaton, 2020). Furthermore, encouraging gender diversity in aviation education can help attract and retain talented women who can serve as role models, inspiring future generations to pursue careers in aviation (Guerrieri, 2024).

Despite the acknowledged advantages of gender diversity, the current representation of women in aviation education continues to present a significant challenge. Women in this field still encounter numerous obstacles, such as societal stereotypes, cultural norms, personal biases, and a scarcity of female role models and mentors (Marete *et al.*, 2022; Turner, 2022; Lutte, 2021). These factors contribute to the persistent underrepresentation of women in aviation education programs and, consequently, throughout the aviation industry (Seligson, 2019; Lutte, 2021).

Addressing these challenges and promoting greater gender diversity in aviation education necessitates a comprehensive and diversified approach. This literature review will explore the historical context of women's participation in aviation, analyze the primary barriers that have impeded their involvement, and investigate the ongoing initiatives aimed at enhancing gender diversity in the field. By synthesizing existing research and highlighting areas that require further study, this review seeks to offer a thorough understanding of the current situation and outline the necessary steps to achieve greater inclusivity in aviation education.

LITERATURE REVIEW

Historical Context

The history of women's participation in aviation has been characterized by notable achievements as well as enduring barriers to entry. From the earliest days of flight, pioneering women have made substantial contributions to the field, helping to pave the way for future generations (Guerrieri, 2024).

Harriet Quimby stands out as a significant figure in aviation history, becoming the first American woman to obtain a pilot's license in 1911 (Guerrieri, 2024).

¹ Philippine State College of Aeronautics, Philippines

^{*} Corresponding author's email: jonahonagonzalo@gmail.com



Quimby's achievement was a groundbreaking milestone that challenged societal norms confining women to domestic roles, thereby opening new opportunities for their involvement in the rapidly developing field of aviation. Similarly, Betty Crites Dillon made history as the first woman to earn a commercial pilot's license in the United States (Guerrieri, 2024).

Despite these early milestones, the aviation industry has remained predominantly male-dominated, with women continuing to face substantial barriers to entry and career advancement (Marete *et al.*, 2022; Turner, 2022). Deeply entrenched cultural norms and gender stereotypes have significantly shaped the industry's environment, often discouraging women from pursuing aviation careers (Lutte, 2021).

The male-centric culture prevalent in the aviation sector has historically created a less inclusive environment for women. Some studies suggest that while many female pilots may not have been directly aware of sexism or experienced it firsthand, they still perceive a sense of bias. This perception of exclusion, combined with a scarcity of visible female role models, has further intensified the challenges faced by women in aviation education and careers (Guerrieri, 2024; Lutte, 2021).

Over time, the role of women in aviation has gradually evolved, with increasing recognition of the value of gender diversity within the industry. Organizations like Women in Aviation International (WAI) have emerged, offering support, networking, and mentorship opportunities for women in aviation. These initiatives have helped to inspire and empower a new generation of female aviators, highlighting the significant contributions women can bring to the field (Rice, 2019).

Additionally, the aviation industry has seen a gradual rise in the representation of women in various roles, including pilots, air traffic controllers, and maintenance technicians (Marete & Wang, 2024). Although progress has been slow, it reflects a growing awareness of the need to address the gender imbalance and to create more inclusive educational and career opportunities.

The historical context of women's involvement in aviation, characterized by both groundbreaking achievements and ongoing barriers, provides a foundation for understanding the current challenges and efforts to promote gender diversity in aviation education. By exploring the evolution of women's roles and the significant milestones in this journey, we can better understand the importance of addressing the gender gap in this crucial industry.

Challenges Faced by Women

Despite the growing recognition of the importance of gender diversity in aviation education, women continue to encounter substantial barriers that hinder their participation and advancement in this field (Ferla & Graham, 2019). The literature reviewed reveals a range of systemic, cultural, and institutional challenges that have historically limited women's representation in aviation

education and careers.

One of the primary issues identified is the persistence of gender stereotypes and biases within the aviation industry (Marete *et al.*, 2022; Turner, 2022). The perception of aviation as a male-dominated field has reinforced the belief that women are less suited for or interested in pursuing careers in this sector. These deeply ingrained stereotypes and cultural norms play a significant role in discouraging women from considering aviation education and training programs (Lutte, 2021).

The lack of female role models and mentors in aviation education further exacerbates the challenges faced by aspiring female students (Guerrieri, 2024; Lutte, 2021). The scarcity of visible women in leadership positions and technical roles within the industry creates a feedback loop, where the absence of female representation reinforces the idea that aviation is not a welcoming or viable career path for women. This lack of role models and mentors can significantly impact the confidence and aspirations of young women considering aviation education (Lythe, 2024; Guerrieri, 2024).

Moreover, the aviation industry is often characterized by a deeply entrenched masculine culture that can be resistant to change (Marete et al., 2022 & Turner, 2022). This culture can manifest in various ways, such as the perpetuation of gender-based stereotypes, the marginalization of women's contributions, and the creation of an unwelcoming or even hostile environment for female students and professional. Dealing with this cultural environment poses significant challenges for women seeking to excel in aviation education and careers. The impact of gender roles and expectations on women's participation in aviation education is another significant barrier (Seligson, 2019; Lutte, 2021). The disproportionate burden of domestic and caregiving responsibilities often placed on women can make it more difficult for them to undertake the intensive training and time commitments required in aviation education programs (Seligson, 2019; Lutte, 2021). These work-life balance challenges can be a substantial deterrent for women considering careers in the aviation industry.

Additionally, the financial barriers associated with aviation education and training can disproportionately affect women. The high costs of flight training, aircraft rental, and other aviation-related expenses create significant hurdles for aspiring female pilots and technicians, further limiting their access to these educational pathways (Lutte & Morrison, 2022).

The combination of systemic barriers, cultural biases, gender role expectations, and financial constraints has contributed to the persistent underrepresentation of women in aviation education programs (Seligson, 2019; Lutte, 2021). Addressing these complex challenges is essential for creating a more inclusive and diverse aviation education ecosystem that attracts and retains talented female students.

As the industry acknowledges the importance of gender



diversity, the next step is to implement focused initiatives and programs that can effectively dismantle these barriers and create an environment that empowers women to pursue their aspirations in aviation education and careers. The literature highlights the need for collaborative efforts between educational institutions, industry stakeholders, and decision-makers to address the systemic challenges faced by women in this field.

Current Initiatives and Programs

In response to the ongoing gender imbalance in aviation education, various initiatives and programs have been developed to address this pressing issue. These efforts focus on increasing female participation, providing mentorship and support networks, and promoting more inclusive institutional policies to enhance gender diversity within the aviation sector (Dhiman, 2023).

One notable initiative is the Women in Aviation and Aerospace Charter, which has been adopted by numerous organizations across the industry. The charter provides a framework for advancing gender equality, with signatories committing to specific actions such as increasing the representation of women in senior roles, supporting the career development of female employees, and implementing inclusive recruitment and retention practices. By establishing industry-wide standards and accountability, the charter has galvanized collective action toward improving gender diversity in aviation education and career (Casebolt, 2023).

In addition to the charter, various industry associations and educational institutions have launched focused programs to encourage and support women's participation in aviation. For instance, the International Aviation Women's Association (IAWA) has led mentorship initiatives that connect experienced female aviation professionals with aspiring students and young professionals. These mentorship programs not only offer guidance and career advice but also provide inspiration and valuable networking opportunities for women advancing through the aviation sector.

Similarly, educational institutions have introduced outreach and recruitment initiatives aimed at increasing female enrollment in aviation programs (Ungcad *et al.*, 2024). These initiatives include organizing events, offering scholarships, and collaborating with organizations such as Women in Aviation International (WAI) to raise awareness and establish pathways for young women interested in aviation careers. By proactively engaging with prospective female students and providing essential resources and support, these initiatives seek to address the gender gap at the educational level.

Correspondingly, several aviation companies and organizations have developed internal programs and policies to cultivate more inclusive work environments (Noor et al., 2024). This includes implementing diversity and inclusion training, revising hiring and promotion practices to reduce unconscious biases, and establishing employee resource groups for women (Cristaudo et al.,

2023). These measures not only support the professional development of women within the industry but also contribute to creating a more welcoming and equitable culture within aviation education and training programs. These comprehensive initiatives and programs, implemented across both the aviation industry and educational institutions, reflect a growing commitment to enhancing gender diversity. Through mentorship, networking opportunities, focused outreach, and inclusive policies, these efforts strive to create a more supportive and equitable environment for women in aviation education, ultimately promoting a more diverse and innovative future for the industry.

Impact of Gender Diversity

The advantages of promoting greater gender diversity in aviation education are extensive and significant. Beyond the fundamental aspects of equity and social justice, enhancing female representation in this field can lead to substantial improvements in learning outcomes, drive innovation, and boost the overall competitiveness of the aviation industry (Lythe, 2024; Walsh, 2024).

A key benefit of improving gender diversity in aviation education is the potential to strengthen learning and problem-solving abilities. Inclusive educational environments that represent diverse perspectives expose students to a broader array of experiences, approaches, and thought processes (Lythe, 2024; Walsh, 2024). This diversity of thought can promote more comprehensive and innovative solutions to the complex challenges encountered in the aviation sector (Walsh, 2024; Seaton, 2020).

Research indicates that gender-diverse teams often outperform their more homogeneous counterparts in areas such as decision-making, crisis management, and risk mitigation (Lythe, 2024). The inclusion of women in aviation education can bring unique problemsolving strategies, communication styles, and emotional intelligence that complement the traditional technical skills commonly associated with the industry (Lythe, 2024). This combination of diverse strengths can significantly enhance the overall effectiveness and adaptability of the future aviation workforce (Walsh, 2024; Seaton, 2020).

Furthermore, the benefits of gender diversity extend beyond the educational context. When women are actively encouraged and supported in pursuing aviation-related careers, they can become influential role models and sources of inspiration for future generations (Lythe, 2024; Guerrieri, 2024). The visibility of successful female pilots, engineers, and aviation professionals can challenge existing stereotypes, stimulate the interest of young women, and showcase the extensive opportunities available within the industry (Lythe, 2024; Guerrieri, 2024).

The case study of the Women in Aviation International (WAI) organization exemplifies the transformative potential of gender diversity initiatives (Rice, 2019). Through its mentorship programs, networking events, and advocacy efforts, WAI has empowered numerous women to explore and excel in aviation education and



careers (Rice, 2019). The organization's success in creating a supportive community and highlighting female role models has had a significant impact, encouraging more young women to view aviation as a viable and rewarding career path (Rice, 2019).

Similarly, the growing presence of women in various aviation roles-such as pilots, air traffic controllers, and maintenance technicians-demonstrates the positive effects of gender diversity. As these women advance in their careers and showcase their skills, they help to challenge longstanding stereotypes and promote a more inclusive culture within the aviation industry.

The advantages of gender diversity in aviation education extend beyond individual benefits, contributing to the overall competitiveness and innovation of the industry. By utilizing a broad range of talents and perspectives, the aviation sector can better address the evolving needs of a diverse global clientele and develop more specific solutions (Walsh, 2024; Seaton, 2020). This diversity of thought and approach can lead to the creation of more user-centric products, services, and operational strategies, ultimately enhancing the industry's adaptability and market appeal (Walsh, 2024; Seaton, 2020).

As the aviation industry confronts critical challenges, such as the anticipated pilot shortage and the need for more sustainable practices, the importance of utilizing the diverse talents and perspectives of women in aviation education becomes increasingly clear (Korba *et al.* 2023). By nurturing an inclusive and supportive educational environment, the industry can access a wider talent pool, stimulate innovative solutions, and ensure a more resilient and adaptable future.

In summary, the impact of gender diversity in aviation education is both profound and extensive. Enhancing learning outcomes, improving problem-solving capabilities, inspiring future generations, and boosting the industry's competitiveness are among the undeniable benefits of increasing female participation in this field. By addressing ongoing barriers and developing more inclusive educational pathways, the aviation sector can harness the transformative potential of gender diversity and position itself for sustained success.

MATERIALS AND METHODS

This review on gender diversity in aviation education adopts a systematic and structured approach to present a comprehensive overview of the existing research and studies on this topic. This ensures a thorough and well-organized review that provides meaningful perspectives on gender diversity in aviation education and guides future research and strategy development. This study adopted a systematic review methodology to compile and analyze secondary data on gender diversity in aviation education. Initially, 35 relevant academic sources were identified through a search of databases including Google Scholar, JSTOR, ResearchGate, Scholarly Commons, Academia. edu, and specialized aviation industry sources. Of these, 18 were deemed relevant after applying inclusion criteria,

such as publication within the last 10 years and a focus on aviation education. Articles with minimal focus on gender diversity or lack of peer review were excluded. The selected articles were subjected to thematic analysis, where significant gaps, common challenges, initiatives and outcomes were identified, categorized, and critically reviewed to assess the current state of gender diversity in aviation education.

RESULTS AND DISCUSSION

This review on gender diversity in aviation education reveals several significant themes and findings. Despite various initiatives aimed at closing the gender gap, the representation of women in aviation education remains disproportionately low. Data consistently show that only around 12% of students in aviation-related programs are women, reflecting deep-rooted systemic, cultural, and institutional barriers.

Systemic Barriers and Gender Stereotypes

One of the most persistent barriers is the cultural perception of aviation as a male-dominated field. Studies suggest that societal stereotypes, which position aviation careers as masculine, discourage women from pursuing education in this field. These gendered perceptions are reinforced through media, educational institutions, and even within family structures, where traditional gender roles often steer women away from technically demanding fields like aviation. Moreover, the perception that women are less capable of handling the physically and technically demanding aspects of aviation further alienates potential female candidates. Studies reviewed in this analysis indicate that many young women view aviation as an unwelcoming and difficult career path, further reinforced by a lack of visible female role models in the field.

Financial Barriers and Access to Education

Another key issue highlighted by the review is the financial burden associated with aviation education. Aviation training, particularly pilot training, is extremely costly, and women, especially those from lower-income or underrepresented backgrounds, face greater financial obstacles in accessing these programs. Scholarships and financial aid aimed at supporting women in aviation exist but are insufficient to close the gap, especially when compared to the financial needs required to complete extensive training. Financial barriers also disproportionately impact women who may already be grappling with other societal constraints such as caregiving responsibilities. Research suggests that women, more than men, may struggle to balance aviation training with domestic responsibilities, leading to higher attrition rates among female students.

Role Models, Mentorship, and Institutional Support

The scarcity of female role models and mentors in aviation education is a critical factor contributing to the gender gap. Many of the reviewed studies emphasize that



young women in aviation education lack visible figures they can identify with, which negatively impacts their confidence and aspirations. While organizations such as Women in Aviation International (WAI) and mentorship initiatives provide valuable support, their reach is limited. Current programs are often underfunded or not sufficiently integrated into educational systems to provide long-term guidance. Mentorship is vital in aviation, where the complexities of training and certification can be challenging. The lack of experienced female mentors often leaves aspiring women without proper guidance in this male-dominated field. Meaningful progress requires deeper structural changes, such as gender sensitivity training and inclusive policies that address the specific challenges women face.

Institutional and Cultural Challenges

Institutional cultures within aviation education remain predominantly male-oriented, contributing to a hostile or unwelcoming atmosphere for women. Several studies emphasize that even when women do enter aviation programs, they often feel isolated and unsupported. The lack of a critical mass of female students means that women may struggle to build peer networks that provide emotional and academic support. Moreover, many institutions have not implemented adequate measures to address these issues, contributing to higher dropout rates among female students.

Existing Initiatives and Their Effectiveness

Various initiatives have been developed to address these barriers, yet the analysis reveals that their impact has been limited. Programs like the Women in Aviation Charter and the International Aviation Women's Association (IAWA) mentorship initiatives aim to encourage women to pursue aviation careers by providing networking, mentorship, and advocacy. While these initiatives are well-intentioned and have shown localized success, their long-term impact on increasing gender diversity remains to be fully realized. For example, although the Women in Aviation Charter has led to a growing awareness of gender diversity issues within the industry, its implementation is uneven across educational institutions and regions. Some schools have embraced the Charter's guidelines by promoting female role models and revising recruitment strategies, while others have been slow to adopt meaningful changes. Additionally, many initiatives focus primarily on increasing the number of women in leadership roles rather than addressing foundational issues at the educational level where disparities begin.

Intersectionality and Additional Marginalization

A critical gap identified in the literature is the lack of attention to intersectionality. Women from racial, ethnic, and socioeconomic minority groups face additional challenges in aviation education, yet this intersectional analysis is often absent from both policy discussions and academic research. The reviewed literature highlights the

need for a deeper understanding of how these intersecting identities compound barriers to entry and advancement for women in aviation. For instance, women of color or those from lower socioeconomic backgrounds are even more underrepresented, facing compounded stereotypes, discrimination, and financial challenges.

Interpretation of Findings

The analysis of the secondary data indicates that while progress has been made in recognizing and addressing gender disparity in aviation education, structural barriers continue to prevent significant change. Initiatives aimed at increasing diversity are often undermined by deeply entrenched gender biases that persist within both educational institutions and the broader aviation industry. Although there is a growing recognition of the need for mentorship, financial support, and institutional reform, these efforts remain fragmented and insufficient. The findings suggest that more comprehensive and sustained efforts are necessary to create an aviation education environment that is genuinely inclusive. Additionally, further research is needed to explore the intersectional challenges that minority women face, as current literature largely overlooks these compounded issues.

Moving Forward

Addressing these challenges requires a holistic approach that integrates educational reforms, industry collaboration, and policy initiatives. Institutions must implement stronger diversity policies, provide more financial support to women, especially those from marginalized backgrounds, and actively foster a more inclusive culture. Mentorship programs should be expanded and embedded into aviation training programs to offer long-term support for women pursuing aviation careers. Furthermore, the success of gender diversity initiatives should be critically evaluated through longitudinal studies that track the progress of women in aviation education and their subsequent careers. Without a sustained commitment to reform, the aviation industry risks losing out on the diverse talents and perspectives that women bring to the field, which are essential for innovation, problem-solving, and adapting to the global challenges of the aviation sector.

CONCLUSION

This review demonstrates that the aviation education sector continues to face significant gender disparities due to persistent systemic barriers, such as entrenched stereotypes, financial obstacles and a lack of mentorship. Despite progress made through initiatives like the Women in Aviation Charter and mentorship programs, these efforts have only marginally increased female participation. The analysis reveals that deeply rooted societal biases continue to frame aviation as a male-dominated field, limiting the effectiveness of such initiatives.

Financial barriers remain a significant challenge, particularly given the high cost of aviation training, which



disproportionately affects women, particularly those from underrepresented backgrounds. Although mentorship programs have shown promise in supporting women entering the field, their reach and long-term impact remain limited. Moreover, institutional reforms although initiated in several places, should be more robust and widespread to cause significant change.

The findings underscore the need for sustained, collaborative efforts across educational institutions, industry organizations, and policymakers to dismantle these barriers and create more inclusive environments. Promoting role models, providing financial support and revising recruitment and retention policies are essential for fostering a diverse and innovative aviation workforce. In conclusion, achieving gender diversity in aviation education requires not only ongoing initiatives but also structural changes that actively support women in overcoming the unique challenges they face. Addressing these issues is critical for fostering innovation, enhancing problem solving, and ensuring the future sustainability of the aviation industry.

RECOMMENDATION

To promote greater gender diversity in aviation education, a comprehensive approach is essential. Institutions should implement targeted outreach initiatives, mentorship programs, and financial support tailored to female students. Additionally, promoting visible female role models in aviation can inspire young women to consider careers in this field. Stakeholders must work collaboratively to reduce systemic biases, revise recruitment and retention policies, and foster a more inclusive culture. Finally, ongoing research should focus on evaluating the long-term impact of current diversity programs and developing new strategies that address intersectional barriers faced by women in aviation.

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