

## **Do Diversity Policies Work? Considerations for the Retention of Underrepresented Students in Collegiate Aviation Programs**

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Dr. Shannon McLoughlin Morrison is the Curriculum and Assessment Manager and Diversity Coordinator for the Center for Aviation Studies in the College of Engineering at The Ohio State University. She holds multiple Master's degrees, one in educational psychology and philosophy and the other in public policy, from The Ohio State University. She earned her doctorate in educational studies with a focus on the history and philosophy of education. In addition, she has completed several graduate-level courses in the Department of Women's, Gender, and Sexuality Studies. Dr. Morrison's public policy master's thesis was a research study on diversity policy in the Center for Aviation Studies and whether or not that policy impacted students' considerations for leaving the academic program. Her expertise is in curriculum development, especially as it pertains to women and underrepresented minorities in education. Dr. Morrison takes an interdisciplinary approach to research, using both qualitative and quantitative methods that were informed by her background in education and public policy.

## **Introduction**

According to Evans (2013) less than 20 African American women are pilots in the United States. These twenty make up the 4% of women, or 6,994, who hold an Airline Transport Certificate (ATP) (U.S. Civil Airmen Statistics, 2018), which is a requirement by the Federal Aviation Administration (FAA) if an individual wishes to be a pilot for a major airline company (e.g. Delta, Southwest, United, and American Airlines). The numbers of other underrepresented individuals, including other women of color (Latinx, Asian, Indigenous, etc.), non-binary individuals, and LGBTQ+ are even less known. With numbers so low, and a growing push for diverse and inclusive work environments, there has been a growing interest on the part of the industry to attract and recruit more women of color and other underrepresented minorities to pursue careers in the aviation and aerospace industries.

However, the lack of women and underrepresented persons in the industry is indicative of a larger problem within the aviation industry and questions remain as to why these particular kinds of individuals are not pursuing these careers. Aviation is not unique in this way from other Science, Technology, Engineering, and Math (STEM) fields, where the struggle to attract and retain underrepresented individuals is ongoing. While the industry itself has made some strides in trying to create a more diverse and inclusive workforce, the evidence indicates that there is still a gap that is not being filled. The response for many STEM fields, including aviation, has been to address this gap by looking to outreach and collegiate programming initiatives to bring more underrepresented students into the field.

Over the last 5-10 years, there has been an increasing effort to create programming at collegiate institutions with the intent to recruit and retain underrepresented/minority students. One of the ways in which this is assessed is through an increasing amount of research activity. This research is predominantly concerned with the retention of underrepresented and minority students as an outcome of an established program. For instance, Tomasko, Ridway, Waller, and Olesik (2016) looked at underrepresented minorities' (Hispanic, African American, and Native American), first-generation students,' and females' participation in a six-week bridge program that occurred prior to the students' enrollment at a land grant research institution. They found that participation in this program was statistically significant for retention to major (into a student's third year) for African Americans, Hispanics, Native Americans, and females. On the other hand, the findings were not

statistically significant for first-generation students. The primary finding was that students needed *both*; a sense of belonging and academic support structures in order to persist in STEM. Additional work by Burger (2018), Pawley (2017), and Tinto and Pusser (2006) suggests that while programming itself is important, this alone does not complete the picture when thinking about implementing diversity and inclusion policies and programming within higher education institutions.

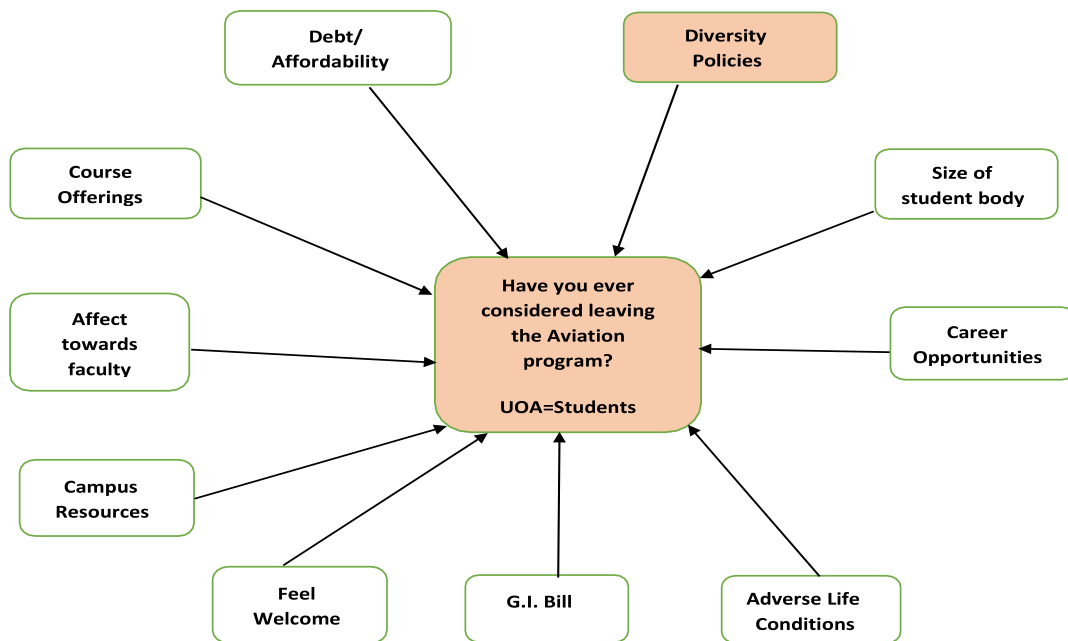
Given the persistent gap in underrepresented groups pursuing aviation careers, and after a review of the prior research, a pilot project was conducted during the summer of 2018 and included a quantitative questionnaire that was administered to select aviation students. Given that existing research indicates a need for a more holistic approach to diversity and inclusion policies and programming, the primary research question was ***“Do diversity and inclusion policies impact collegiate students’ considerations for leaving an (aviation) academic program?”***

## **Methods**

Much of the existing research that is conducted about diversity and inclusion policies uses longitudinal data and asks study participants to journal about their experiences in STEM fields over a period of time (Burger 2018). While this prior research is important in identifying and understanding the student experience and lays the foundation for understanding these issues, this pilot study moves the research forward. This project looked at how diversity programming operates in conjunction with other elements of the student collegiate experience. Interactions with faculty, access to a variety of curricula, and availability of resources (financial aid, parking, etc.) are just some of the primary influences on the student collegiate experience (Burger 2018, Pawley 2017; Robertson and Mason, 2008; Tomasko, Ridgway, Waller, and Olesik 2016). This research collectively evaluates multiple measures for student persistence in an academic program.

In order to analyze the impact of multiple variables on student retention, the conceptual framework shown in Figure 1, was used:

Figure 1: Conceptual Framework of Student Exposure to Diversity Policy



The primary research question was represented through the dependent variable labeled in the center of Figure 1 (*consideration of leaving*). Evaluation of this question involved the use of an independent variable, *diversity policies* which is highlighted above, and a series of control variables (non-shaded) intended to determine the potential influence of other variables on the student experience (remaining variables in the graph). This conceptual framework was designed to assess as many potential factors on a student’s consideration for leaving an aviation program as possible. By considering all potential variables, a more complete representation of potential outcomes or effects of diversity policy could be assessed.

The dependent, independent, and control variables were evaluated through the implementation of a Qualtrics survey that was administered to 75 students who, per university records, had identified as women and/or of a racial/ethnic background. These students were selected because current research indicates that these individuals are most susceptible to not being retained in a STEM academic program. Diversity policies at academic institutions are also typically directed at this particular group of students.

This research used a survey, or a non-experimental research design to collect data for analysis. Where this project diverges from prior research (e.g., Burger 2018; Pawley 2017; Robertson

& Mason; 2008, Tomasko, Ridgway, Waller, & Olesik 2016) is in its consideration for those variables that might influence a students' consideration for leaving, in conjunction with diversity and inclusion policies. As such, the Qualtrics survey that was developed for the pilot study leverages questions about student exposure to diversity and inclusion policies, as well as their perceptions and experience with other influences to academic persistence. Appendix A and B is a graphic representation of the connection between the variable being evaluated and the survey question it represents.

### **Logit Regression Model**

This research project was designed with the following hypothesis in mind:

*H<sub>1</sub>: Women and minority students who are exposed to diversity and inclusion policies are more likely to remain in the aviation program*

Given the existing research of student retention to major (Tomasko, Ridgway, Waller, and Olesik 2016), and its connection to participation in diversity programming, an assumption could be made that diversity programming was the key to retaining students and preventing them from dropping-out. In order to compare this factor to other variables within the student collegiate experience, the following logit regression model was used:

$$P_1 (\textit{leaving}) = \frac{1}{1 + e^{-(B_1 + B_2 * DIPolicy_2 + B_3 * AVNCourses_3 + B_4 * Debt_4 + B_5 * Faculty_5 + B_6 * OSUResources_6 + B_7 * Welome_7 + B_8 * G.I_8 + B_9 * Student\_Body_9 + B_{10} * Career_{10} + B_{11} * Degree_{11} + B_{12} * Life\_Conditions_{12})}}$$

This logit model represents the dependent variable (*leaving*) and compares it to all other possible factors, including the diversity programming.

The question on *leaving* was not a simple yes or no, but the degree to which the student considered it, therefore the survey responses were non-binary. Students could indicate that they had strongly considered leaving, or that they had not considered leaving at all. Analysis of this kind of data cannot be accomplished through an OLS, or linear regression model. Instead, a logit regression model was developed (Gujarati 2008) (see above). This model was selected to assess (and rule out) a series of control variables that were identified as being illustrative of considerations for leaving from existing research. In order to understand the impact of diversity policy (if any) the other variables need to be assessed and evaluated.

## Preliminary Results

A review of the results indicates that there is a high correlation amongst several of the variables. For example, an analysis of the correlation between course satisfaction (*course\_satisfaction*) and faculty (*faculty*) indicated a Pearson correlation coefficient exceeding 60 percent. This was true for several other explanatory variables including, but not limited to faculty, sense of community (*sense\_community*), financial aid (*finaid\_info\_available*), awareness of the center's diversity initiatives (*aware\_diversity*) and sense of community (*sense\_community*). This is consistent with prior research which suggests that perceptions of student experiences consist of strongly correlated variables (Tomasko, Ridgway, Waller, and Olesik 2016).

Prior to the evaluation of survey results, it was assumed that the following logit regression model would be appropriate in the evaluation of the dependent variable (*leaving*):

$$P_1(\text{leaving}) = \frac{1}{1 + e^{(B_1 + B_2 * DIPolicy_2 + B_3 * AVNCourses_3 + B_4 * Debt_4 + B_5 * Faculty_5 + B_6 * OSUResources_6 + B_7 * Welome_7 + B_8 * G.I_8 + B_9 * Student_Body_9 + B_{10} * Career_{10} + B_{11} * Degree_{11} + B_{12} * Life_Conditions_{12})}}$$

However, after an initial review of the data, it became evident that several of the variables were highly correlated with one another. This indicated that an analysis which produced statistically significant results would be a challenge. Determining whether or not a student was considering leaving the program due to experiences with faculty, rather than their exposure to diversity policy (for example) was not possible given the high correlation amongst variables.

In response to this discovery, it was necessary to re-evaluate and re-design the logit model that was used for analysis. Considerations for which factors were highly correlated to one another was the primary consideration. Below are the two logit models that were developed in response:

### Model one:

$$P_1(\text{leaving}) = \frac{1}{1 + e^{(B_1 + B_2 * aware\_diversity_2 + B_3 * adverse\_events_3 + B_4 * osu\_resources_4 + B_5 * course\_satisfaction_5)}}$$

### Model two:

$$P_1(\text{leaving}) = \frac{1}{1 + e^{(B_1 + B_2 * aware\_diversity_2 + B_3 * course\_satisfaction_3 + B_4 * sense\_community_4)}}$$

Ultimately, an analysis of the data that was derived from the regression models suggested that there was not a statistically significant connection between the independent and dependent variables (*consideration of leaving and exposure to diversity policy*). Figure 2 demonstrates this through the marginal effects.

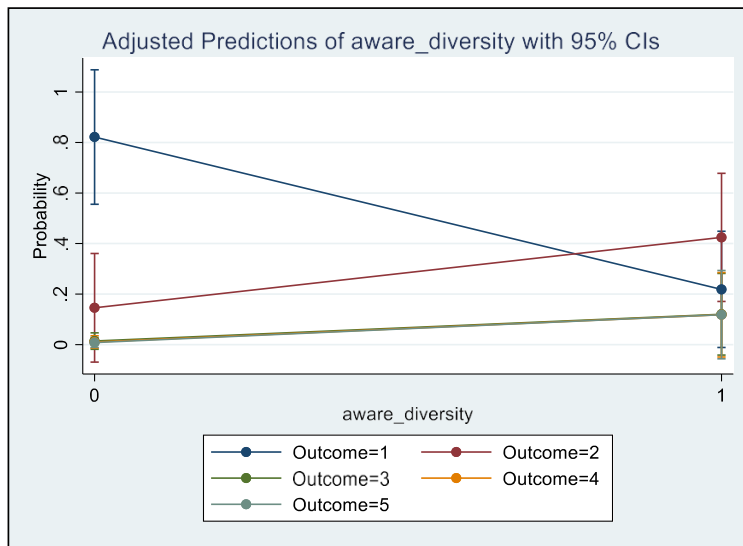


Figure 2: Awareness of diversity at means with 95% confidence

Preliminary results suggest that, the more likely a student has been exposed to diversity policy, the less likely they are to consider leaving the program. However, the range of the 95% confidence interval is too wide. In order to increase the significance of the results, a smaller range of the 95% confidence interval would be needed. One way to accomplish this is through a larger sample size of survey results. This would likely increase the significance of the confidence interval.

## Conclusions

The primary conclusion of this research paper supported existing research that indicates that the student experience, at the university level, is multi-faceted. Consideration for a variety of variables, should be given, when developing diversity policies or programming for its students.

## Limitations

While this research paper did in fact reaffirm some of the findings of previous research (the relevance of multiple variables in students' considerations of leaving) there continue to be some gaps that would benefit from additional research on this subject. One consideration for

future research would be to ‘scale up’ the administration of the survey by having aviation students from multiple university or collegiate programs participate. That would address the concerns over a smaller sample size and likely present some additional interesting findings.

Given that the survey asked students to respond with their perceptions of diversity programming within the university at a particular time, it would likely be beneficial for future researchers to consider conducting interviews and/or asking students to journal about their experiences over the long term. This kind of qualitative research would illuminate some of the findings that cannot be easily dissected through the quantitative statistical analysis alone.

Finally, this paper only sampled women and people of color. Additional research needs to be done with the LGBTQ+ community. Part of the challenge with the research on underrepresented groups and STEM, is the assumption that the experiences of all groups of minorities are the same. Not only is further research needed in order to better serve *all* students, great care in how that research is conducted is imperative.

### *Policy Alternatives*

Current diversity and inclusion policies in the Center for Aviation Studies revolve around creating and sustaining more student organizations, creating more inclusive curriculum, and bringing in guest speakers that are of diverse backgrounds. While these things are positive contributions to the Center and its programming, they may not be enough to address those students who potentially consider leaving the program. The analysis conducted here reaffirms findings within existing research (Tinto and Pusser 2006), that, in order for diversity and inclusion policies to work, consideration should be given to the entirety of the student experience. Considering the ways in which the variables from this particular survey were highly correlated, assuming that diversity and inclusion policies are the key to student retention (alone) does not do justice to the myriad of reasons for why a student may or may not consider leaving a program.

The primary policy recommendation that this paper puts forth is that diversity and inclusion policies should not be limited to simply altering the curriculum, bringing in diverse faculty, or offering (tailored) specific student experiences, but should also include those factors that contribute to the day-to-day experiences of students. Faculty involvement, financial assistance, classroom environment, and personal support, are all contributing factor to the



success and persistence of students in higher education programs (Burger 2018, Pawley 2017, Robertson and Mason, 2008, Tomasko, Ridgway, Waller, and Olesik 2016). This is not to suggest that incorporating diverse perspectives aren't important, but that these changes need to be done in conjunction with those factors that students encounter on a daily basis. If resources are going to be given to implementing more diverse and inclusive practices at higher education institutions, then some consideration needs to be given to these factors that have been identified as contributing to successful student persistence.

Part of the survey also included open-ended questions. One specific question that was asked was "What should the Center for Aviation Studies be doing about Diversity and Inclusion that we have not asked about?" While these responses were not coded and used as part of the calculation of the survey results, some of the student comments could help direct future research:

*"Definitely advertise the efforts and courses more towards the freshmen and sophomores as well as to prospective students during tours and visits. Perhaps explain to students why the Center is pushing its diversity and inclusion initiatives."*

*"Offer training and scholarships to Columbus schools like the Graham School or Afro Centric to expose minorities to aviation."*

*"It all starts with the students, we need to educate everyone about the problems that still occur today and teach them what to look out for and how they can improve diversity and inclusion."*

What is most interesting about these responses is the belief that diversity and inclusion policies are necessary to create a more equitable aviation industry. This qualitative feedback in conjunction with the quantitative results indicate a need to continue to research the persistence of women and people of color in aviation academic programs and the industry at large. Particularly given the demand of professionals that the industry is facing over the next 10-20 years and the low numbers of women and people of color who pursue aviation careers.

## References

- Barak, Michalle E. Mor (2011). "Managing Diversity: Toward a Globally Inclusive Workplace." 2<sup>nd</sup> e.d. SAGE Publications: London, pp. 59-63.
- Bell, Joyce M.; Hartmann, Douglas (2007). "Diversity in Everyday Discourse: The cultural ambiguities and consequences of 'happy talk.'" *American Sociological Review*. Vol 72 Issue 6, pp. 895-914. <https://doi.org/10.1177/000312240707200603>
- Burger, Catherine E. (2018). *Underrepresented Minority Doctoral STEM Students, Attrition, and Persistence: A comparative descriptive study* (Unpublished doctoral dissertation). Capella University.
- Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage Publications.
- Embrick, David G. (2011). "The Diversity Ideology in the Business World: A new oppression for a new age." *Critical Sociology*. Vol 37 Issue 5, pp. 541-556. <https://doi.org/10.1177%2F0896920510380076>
- Evans, Louwanda, Feagin, Joe R. (2012). "Middle-Class African American Pilots: The continuing significance of Racism. *American Behavioral Scientist*." Vol: 56 Issue: 5, pp. 650-665. <http://psycnet.apa.org/doi/10.1177/0002764211433804>
- Evans, L. (2013). *Cabin Pressure: African American Pilots, Flight Attendants, and Emotional Labor*. New York: Rowman & Littlefield Publishers, Inc.
- Gujarati, Damodar N. (2010). *Basic Econometrics*. New York: McGraw-Hill.
- Healey, Joseph F., Stepnick, Andi (2017). *Diversity and Society: Race, Ethnicity, and Gender*. SAGE Publications: London.
- Kreitner, Robert; Kinicki, Angelo (2010). *Organizational Behavior*. New York: McGraw-Hill.
- Loden, Marilyn; Rosener, Judy B. (1990). *Workforce America!: Managing Employee Diversity as a Vital Resource*. Burr Ridge, Illinois: Irwin Professional Publishing.
- Michaels, Walter Benn (2006). *The Trouble with Diversity: How We Learned to Love Identity and Ignore Inequality*. New York: Metropolitan Press.
- Pawley, A.L. (2017). "Shifting the "Default:" The case for making diversity the expected condition for engineering education and making whiteness and maleness visible." *Journal of Engineering Education*, 106:4, 531-533. <https://doi.org/10.1002/jee.20181>
- Roberston, R.V & Mason, D. (2008). "What Works? A Qualitative Examination of the

Factors Related to the Academic Success of African American Males at a Predominately White College in the South.” *Challenge: A Journal of Research on African American Men*, 14:2, 67-89.

Seron, Carroll, Silbey, Susan S., Cech, Erin, and Rubineau, Brian (2016). “Persistence is Cultural: Professional socialization and the reproduction of sex segregation.” *Work and Occupations*, Vol. 43 Issue 2, pp. 178-214.  
<https://doi.org/10.1177%2F0730888415618728>

Tinto, V. & Pusser, B (2006). “Moving from Theory to Action: Building a model of institutional action for student success.” National Postsecondary Education Cooperative, Department of Education, Washington D.C. Retrieved from  
[https://nces.ed.gov/npec/pdf/Tinto\\_Pusser\\_Report.pdf](https://nces.ed.gov/npec/pdf/Tinto_Pusser_Report.pdf)

Tomasko, D.L., Ridway, J.S., Waller, R. J, & Olesik, S.V. (2016). “Association of Summer Bridge Program Outcomes with STEM Retention of Targeted Demographic Groups.” *Journal of College Science Teaching*, 45:4, 90-99.

## Appendix A: Aviation Climate Survey Part One

Question Type (refer to conceptual framework)	Question	Variable Name
Demographic Questions	Which aviation program are you currently enrolled in?	
	Do you identify as male, female/ not disclose?	
	Which ethnicity do you identify with?	
	I have attended events, used the resources, or interacted with the staff, at the following Ohio State campus organizations.	
	I have participated in the following student organizations	
Research Question (dependent variable)	Have you ever considered leaving the Center for Aviation Studies Academic program?	<i>Leaving</i>
Diversity Policies	Do you believe that The Ohio State University values diversity in its policies and practices?	<i>osu_value_diversity</i>
	Do you believe that the Center for Aviation Studies values diversity in its policies and practices?	<i>center_value_diversity</i>
	My gender and/or racial group membership is important to my sense of identity?	<i>gender_race_identity</i>
	Do you believe that the Center for Aviation Studies is welcoming to people of different gender or racial identities?	<i>center_welcoming</i>
	Do you believe that the industry is welcoming of different gender and racial groups?	<i>industry_welcoming</i>
	How important is it to you to interact with people of diverse backgrounds?	<i>interaction_important</i>
	Are you aware of the Center for Aviation Studies Diversity and Inclusion initiatives?	<i>aware_diversity</i>
	How satisfied are you with the Center for Aviation Studies Diversity and Inclusion initiatives?	<i>center_diversity</i>
	My academic program fosters the development/ advancement of individuals with diverse backgrounds.	<i>program_fosters_diversity</i>

## Appendix B: Aviation Climate Survey Part Two

Question Type (refer to conceptual framework)	Question	Variable Name
Debt/Affordability	I believe the cost of tuition for the Center for Aviation Studies is comparable to other aviation academic programs.	<i>tuition_comparable</i>
	Do you agree that information on student financial aid was readily available?	<i>finaid_info_available</i>
	Do you believe that the available information on student financial aid was adequate?	<i>finaid_info_adequate</i>
Course offerings	My aviation courses are important to my intended career choice.	<i>courses_career</i>
	The Center for Aviation Studies offers a variety of courses, at different times, and on varying subjects, that meet my needs.	<i>courses_variety</i>
	I am satisfied with the Center for Aviation Studies course offerings.	<i>course_satisfaction</i>
	I believe that my degree from the Center for Aviation Studies is competitive with other aviation programs.	<i>degree_competitive</i>
Affect towards faculty	The Center for Aviation Studies lecturers and faculty have made a positive impact on my experience in the programs	<i>faculty</i>
Campus resources	Do you agree that The Ohio State University provides adequate resources to students (e.g. parking, healthcare, housing, etc.)?	<i>osu_resources</i>
Feel Welcome	I have a sense of community in the Center for Aviation Studies	<i>sense_community</i>
G.I. Bill	My degree is funded through the use of the G.I. Bill?	<i>gi_bill</i>
Adverse Life Conditions	I have experienced an adverse life event during my time as a student with the Center for Aviation Studies?	<i>adverse_event</i>
Career Opportunities	The Center for Aviation Studies industry connections will be beneficial to my career.	<i>industry</i>
	I believe that completing the Center for Aviation Studies academic program will provide me with meaningful employment.	<i>employment</i>
	I am confident in my choice of aviation for a profession.	<i>career_confidence</i>
Nominal time to degree	I am satisfied with the time it will take me to complete my degree with the Center for Aviation Studies?	<i>degree_completion</i>
Size of Student Body	I enjoy being a part of a smaller academic program	<i>small_program</i>