Insights from a Practice-Based Program: Connecting Women to Technology and Advancing Diversity in Computing

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Abstract

The Linking Interested Females to Technology (LIFT) program, led by Miami Dade College (MDC), supports diverse groups of women transitioning into computing careers. These include women who are pursuing an Associate of Arts in computer science at MDC with plans to transfer to four-year universities to complete their bachelor's degrees, as well as women who have already earned an associate degree and are now pursuing a Bachelor of Science in computing fields such as data analytics, cybersecurity, and information systems technology at MDC. Key components if LIFT include accelerated coursework, mentorship, technical interview preparation, and opportunities for internships and research. The program provides two years of tailored support: the early academic journey for computer science students and the final academic years for computing students completing their bachelor's degrees. These initiatives align with national diversity goals in computing and promote inclusivity, belonging, and support for underrepresented groups. LIFT's comprehensive design demonstrates success in improving self-efficacy, community support, and academic achievements, with potential for broader application across institutions.

Introduction

Computing and technology occupations are predicted to rise by 7.3% in the next decade, outpacing the national average grow rate of 4.8% [1]. Along with a skilled workforce, the industry needs to maintain a diverse workforce reflecting the community. Currently only 25.8% of computer and mathematical occupations employees are women. Among those, only 23.1% are Asian, 8.7% are Black/African American, and 7.8% are Hispanic/Latinx [2].
Black women alone comprise 7% of the U.S. population [3] and yet make up only 0.5% of computer science degrees awarded [4] and just 3% of computing professionals [5]. Black women also face specific barriers from just being black and a woman. [6], [7], [8], [9]. This lack of diversity inhibits innovation where those companies in the top 25% for racial and ethnic diversity are 35% more likely to have above average financial returns [10]. Additionally, the lack of access to these lucrative and influential fields exacerbates existing socioeconomic inequalities for women [11]. To broaden participation and fill a growing need for professionals in computing/technology, it is important to consider innovative pathways that utilize diverse pools of talent for training and recruitment. It is estimated that by 2030, approximately one-third to one half of employees may desire new occupations and will need to either reskill or upskill [12]. Programs such as LIFT can help make the computing and technology fields more accessible to underrepresented populations, including Hispanic and Black women. This can be accomplished by offering advanced training in knowledge and skills (reskilling or upskilling), along with teamwork, and mentorship opportunities.

Miami Dade College (MDC), the largest Hispanic-serving institution within the Florida College System, has long been a cornerstone of educational access and equity. MDC reflects the diverse demographics of the region: 73% Hispanic, 16% Black non-Hispanic, and 57% women. In the alignment with its fourth strategic goal: Fueling the talent needs of a global economy [13]. MDC

launched the Linking Interested Females to Technology (LIFT) program under the Reboot Representation initiative. Reboot Representation is a coalition of technology companies and organizations, including educational institutions, non-profits, and industry leaders, to provide funding and resources for initiatives aimed at doubling the number of underrepresented women of color earning computing degrees by 2025. This partnership focuses on preparing students for the future of work by implementing high-impact strategies, including improving degree completion rates, offering experiential learning opportunities, and promoting workforce readiness.

The LIFT program at MDC is designed to create an inclusive and supportive environment that empowers students to succeed in STEM and technology careers. By leveraging evidence-based practices, the program improves persistence and engagement in STEM fields. These practices include learning communities to enhance retention [14], [15], mentorship to bolster self-efficacy [16], [17], and experiential learning opportunities, such as internships and research experiences, to provide hands-on career preparation [18], [19]. The program connects participants with industry role models, offers access to advanced academic and career resources, and fosters a sense of belonging in STEM fields.

The initiative supports students pursuing multiple pathways, whether transferring from an Associate of Arts (AA) degree in computer science at MDC to bachelor's programs in computing at four-year universities or completing a Bachelor of Science (BS) degree in computing disciplines at MDC. By equipping students with essential skills and experiences, the LIFT program prepares them to thrive in computing careers. Additionally, it addresses the persistent underrepresentation of women in STEM through these proven strategies [20].

Program Activities

The LIFT program encompasses a multifaceted approach to addressing barriers faced by underrepresented women in computing. To qualify, students must be full-time MDC students with a cumulative GPA of 3.0 or higher. Eligibility is limited to freshmen pursuing an AA degree in Computer Science with fewer than 30 credits or sophomore in a BS degree program in technology disciplines (cybersecurity, data analytics, or information systems technology) with no more than 90 credits. Students must also have completed college algebra and met program admission requirements upon acceptance into the program.

Active participants in the LIFT program receive semester stipends based on merit and financial need, along with a range of activities designed to enhance technical skills, foster mentorship, and create pathways for academic and professional success. The program provides paid summer research and internship opportunities, along with dedicated mentoring to support students' academic and career development. Additional resources for participants include tailored activities and courses to prepare participants for computing careers and seamless transfer to four-year universities, a year-long speaker series, and opportunities for engagement with the tech community. These include networking events, interactions with industry professionals, and career preparation activities (Figure 1).

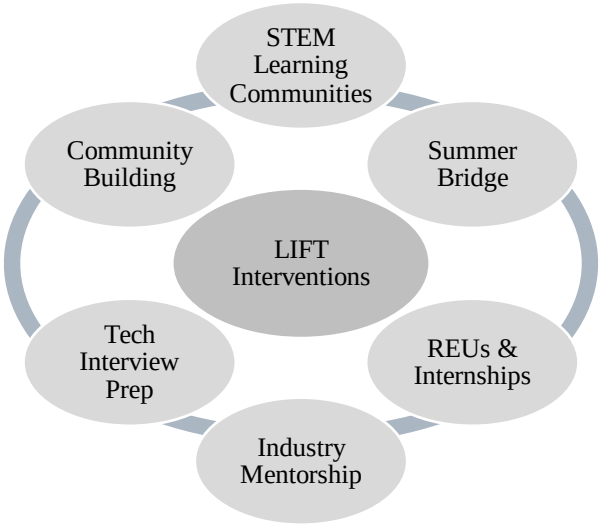

Figure 1. LIFT Program Participants' Activities.

Accelerated Coursework and Learning Communities: The LIFT-adjusted curriculum introduces foundational programming languages, requiring all participants to take Python, along with additional scripting or programming courses like C++ and Java based on their specific computing program. A specialized Calculus and Physics sequence, for computer science students only, pairs Calculus I and Physics I in the fall and Calculus II and Physics II in the spring, taught by STEM women professors who integrate computing-related projects. This approach enhances engagement, accelerates STEM prerequisite completion, and fosters collaboration. By streamlining coursework, it enables students to earn their AA degree in two years instead of three, as most are not initially calculus-ready and must first complete prerequisite math courses. This learning community model allows students to collaborate and build supportive networks while tackling challenging coursework, a critical factor in retaining underrepresented students in STEM fields.

Summer Bridge Program: A cornerstone of the LIFT initiative is the summer bridge program hosted at four-year universities. This program, developed through collaboration with academic advisors, STEM professors, and external organizations, includes academic advising, research opportunities, and seminars. These resources are tailored to prepare participants for the transition to a four-year university, whether to complete an undergraduate degree or to pursue a graduate degree. By addressing potential academic and social challenges, the summer bridge program reinforces students' confidence and readiness for the next phase of their educational journey.

Research Experiences and Internships: Participants engage in paid summer research experiences for undergraduates (REUs) at MDC and four-year universities, gaining hands-on exposure to advanced computing concepts and methodologies. Additionally, LIFT facilitates internship placements with leading technology firms, allowing students to develop practical skills and build industry connections. These experiences are crucial for bridging the gap between academic training and professional success. Due to COVID-19, the first year of the program's implementation required these activities to take place remotely. Participants were then given the choice to engage remotely, in a hybrid format, or in-person.

Mentorship and Networking: LIFT program's mentorship component pairs students with industry professionals through the Reboot Representation Network and academic mentors through MDC faculty mentors who provide guidance, encouragement, and career advice. The networking components in Tech Up Space: Women in Tech Speaker Series invites prominent female leaders from organizations like Amazon, Google, Microsoft, UKG, Accenture, Assurant, Southern Glazer's Wine & Spirits, and other local tech women leaders to share insights, inspiring participants to envision themselves as leaders in the tech industry.

Technical Interview Preparation: Technical interview preparation plays a crucial role in the tech hiring process, which is why LIFT offers tailored preparation sessions to help candidates succeed. These sessions, led by partner CodePath, equip students with the skills needed to excel in interviews for internships and full-time positions, addressing a significant barrier for many underrepresented students entering the tech workforce. CodePath is a nonprofit organization that provides industry-aligned computing and technology courses to prepare students for careers in technology, focusing on bridging gaps for underrepresented groups in the field.

Community Building: Workshops such as #IamRemarkable, a global movement that empowers participants by fostering self-efficacy and resilience. The program's focus on creating a sense of belonging within the tech community has led to increased perceptions of family support, cultural inclusivity, and recognition of computing's societal contributions.

Research Methodology

The LIFT program evaluated its impact using retrospective pre/post surveys from 2022 to 2024, consolidating findings from the 2022-2023 and 2023-2024 reports. Designed by MDC, Reboot Representation, and Creative Research Solutions, the surveys measured self-reported changes in sense of belonging, social impact awareness, technology access, instructor inclusiveness, self-efficacy, computing interest, and cultural responsiveness. This approach enabled cross-year analysis of program trends and outcomes.

The surveys were administered to the same cohort of students over three consecutive years: 2022, 2023 and 2024. Each student completed the survey at the beginning (retrospective pre-program) and end (retrospective post-program) of the LIFT program. The survey items were measured on a Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree), allowing for quantitative analysis of trends over time.

The methodology employed in this study demonstrates several strengths that enhance its ability to assess the program's effectiveness. Incorporating data from the 2022-2023 and 2023-2024 cohorts allowed for cross-year analysis, identifying consistent trends and evaluating long-term outcomes. The longitudinal design, which tracked the same cohort over two years, captured changes in perceptions and outcomes directly attributable to the program. Additionally, the use of the Reboot Success Predictor subscales ensured alignment with both program objectives and industry-recognized metrics, strengthening the relevance and applicability of the findings.

However, the methodology is not without limitations. Variability between the 2022-2023 and 2023-2024 cohorts in initial perceptions and experiences may affect the comparability of results.

The absence of a control group limits the ability to attribute observed changes solely to the program, as external factors could also influence outcomes. Furthermore, reliance on self-reported data introduces potential bias, as participants may provide socially desirable responses. Lastly, the relatively small sample size constrains the generalizability of the findings to larger populations. Despite these challenges, the methodology offers valuable insights into the program's impact and identifies areas for future improvement.

Key Findings – Discussion and Outcomes

The student demographics provide essential context for evaluating the outcomes of the LIFT program (Table 1). Analyzing the diversity of participants, including their racial/ethnic and educational backgrounds, offers valuable insights into how the program fosters inclusivity and addresses the underrepresentation of marginalized groups in computing fields. This evaluation helps identify the program's effectiveness in creating opportunities for underrepresented populations while informing strategies to enhance diversity and equity in technology education and careers.

Table 1. Participant Demographics Across Program Years.

Year in School	Number of Participants Who Identified As Women, By Race/Ethnicity												
	Spring 2022 - Summer				Fall 2022 - Summer 2023				Fall 2023 - Summer 2024				Actual
	Black		Latina		Black		Latina		Black		Latina		Total
	Returning	New	Returning	New	Returning	New	Returning	New	Returning	New	Returning	New	Graduates
First Year / Freshmen	-	2	-	11	-	6	-	14	-	-	-	-	
Second Year / Sophomore	-	-	-	2	2	-	11	-	6	-	14	-	
Third Year / Junior	-	-	-	-	-	-	-	-	-	3	-	10	
Fourth Year / Senior	-	-	-	-		-		-	-	3	-	19	
MDC Graduates (AA in Computer Science)	-	-	-	2	2	-	11	-	6	-	14	-	**35**
MDC Graduates (BS in Data Analytics OR BS in Cybersecurity OR BS in Information Systems Technology)	-	-	-	-	-	-	-	-	-	6	-	29	**35**

The LIFT program evaluation analyzed data collected from two cohorts: 35 students in the 2022-2023 cohort and 35 students in the 2023-2024 cohort. These students were all from underrepresented groups in computing, with everyone identifying as either Hispanic or Black. The participants were enrolled in either AA or BS pathways in computing at MDC. This diverse sample allowed for robust insights into the program's impact on key predictors such as belongingness, self-efficacy, and access to resources.

The integration of data from the 2022-2023 and 2023-2024 reports provided a comprehensive overview of the LIFT program's effectiveness in addressing barriers faced by underrepresented groups in computing. The findings are categorized into key domains that illustrate the program's success and areas for further development.

Sense of Belonging: The LIFT program significantly enhanced students' sense of belonging in computing. In the 2022-2023 cohort, baseline scores for belongingness averaged 3.2, increasing to 3.61 post-program, reflecting a 0.41-point average increase (8.2%). One participant remarked, "I was very, very shy at first, but the group projects and presentations helped me gain confidence. Now, I feel like I belong in the computing field." In 2023-2024, the baseline score

was slightly higher at 3.3, with a post-program score of 3.75, resulting in a 0.45-point increase (9%). This trend indicates sustained and slightly improved impact year over year. To illustrate the impact of LIFT on students' sense of belonging, Figure 2 highlights an increase in participants' confidence and connection to the computing field, demonstrating the program's positive influence.

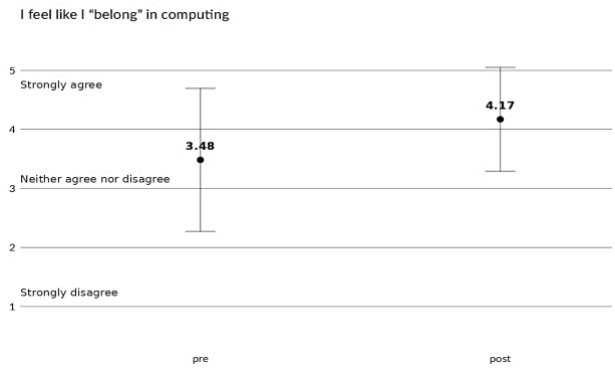

Figure 2. Perception of Belonging in Computing.

Knowledge of Social Impact: Students increasingly recognized the societal contributions of computing careers. In the 2022-2023 cohort, baseline scores averaged 3.1, increasing to 3.6 post-program, reflecting a 0.50-point increase (10%). A participant shared, “The roller coaster project in physics made me see how computing principles apply to everyday life.” In the 2023-2024 cohort, baseline scores were 3.0, rising to 3.75 post-program, marking a 0.75-point increase (15%). These findings underscore the effectiveness of program activities such as guest lectures and real-world project integration. As shown in Figure 3, responses indicate an increase in awareness of the social impact of computing careers, reflecting participants' growing recognition of the field's potential to create meaningful change.

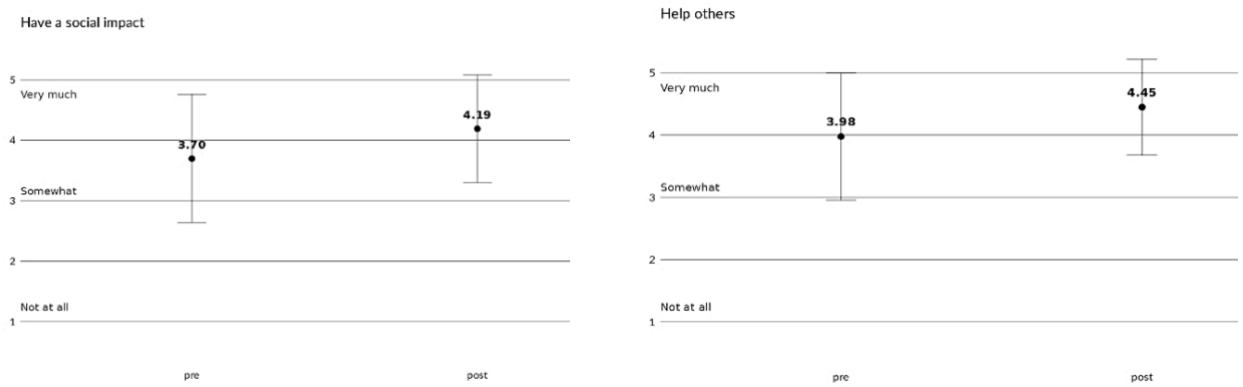

Figure 3. Perception of a Computing Career’s Social Impact and Ability to Help Others

Access to Technology: Participants reported improved access to technology through the program. In 2022-2023, baseline satisfaction with access to necessary technology was 3.5, dropping slightly to 3.3 post-program, indicating a 0.20-point decline (4%). One participant noted, “We need more updated computers to handle advanced computing tasks.” However, in 2023-2024, the baseline score was 3.2, which improved to 3.5 post-program, reflecting a 0.30-point increase (6%). These changes highlight adjustments made to improve technology access.

Instructor Inclusiveness: The findings demonstrated a consistent increase in students feeling supported by their instructors. In the 2022-2023 cohort, baseline scores for instructor support averaged 3.4, increasing to 3.8 post-program, a 0.40-point improvement (8%). One participant noted, “My professor’s feedback on my project was invaluable. It made me realize my potential in technical problem-solving.” The 2023-2024 cohort began with a baseline score of 3.3, rising to 3.9 post-program, representing a 0.60-point increase (12%). These results emphasize the program's focus on fostering an inclusive academic environment, as shown by the changes in responses illustrated in Figure 4.

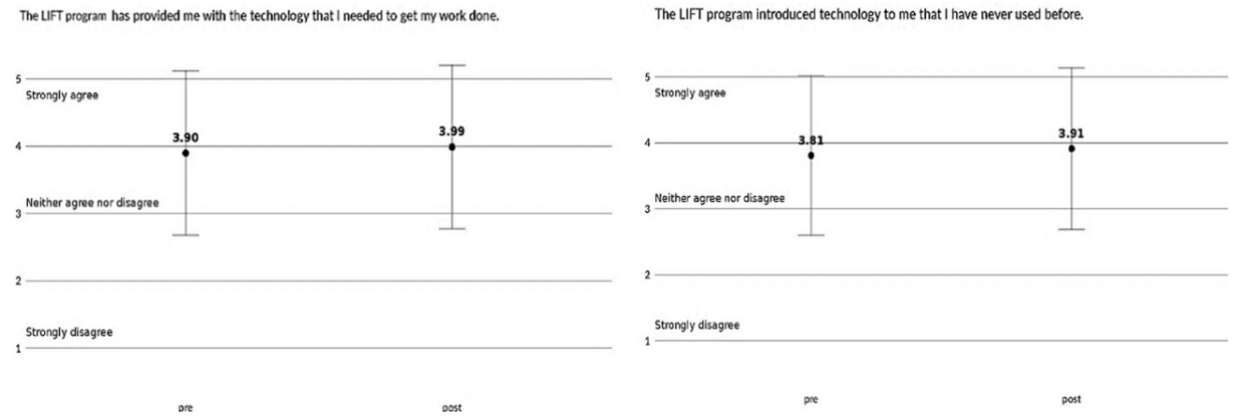

Figure 4. Access to Technology and Introduction to New Technologies.

Self-Efficacy and Interest in Computing: Across both years, students reported increased confidence in their computing abilities and greater interest in the field. In the 2022-2023 cohort, baseline self-efficacy scores averaged 3.0, increasing to 3.71 post-program, a 0.71-point improvement (14.2%). One participant stated, “I now feel confident enough to apply for internships at major tech companies like Google.” The 2023-2024 cohort showed similar growth, with baseline scores of 3.1 rising to 3.9 post-program, reflecting a 0.80-point increase (16%). These results highlight the program's success in fostering resilience and skill development. Figure 5 highlights an example of increased self-efficacy, showcasing participants' growing confidence in their ability to pursue advanced education in computing and effectively communicate technical concepts to diverse audiences.

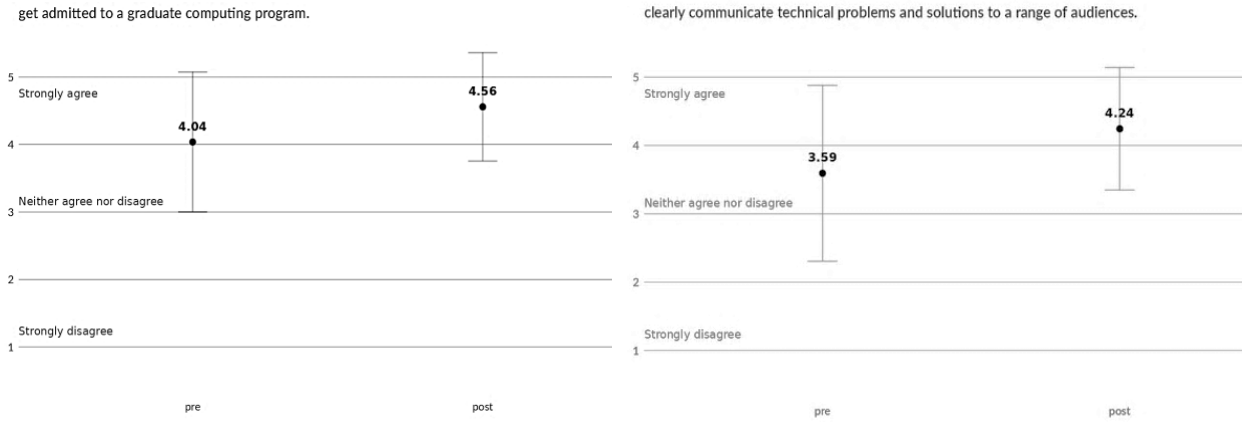

Figure 5. Level of Confidence in Graduate Admission and Technical Communication.

The program demonstrated sustained positive outcomes, with key metrics such as belongingness and self-efficacy showing consistent improvements across both cohorts, underscoring its lasting impact. However, variability in technology access and culturally responsive instruction emerged as areas needing targeted interventions to further enhance program effectiveness.

These findings carry broader implications for addressing underrepresentation in computing fields. The program's success highlights the value of scalable strategies such as mentorship, experiential learning, and tailored academic support, offering a model for promoting diversity and inclusion in technology education.

Conclusion and Recommendations

The LIFT program demonstrates a promising model for addressing underrepresentation in computing disciplines. By targeting key barriers such as access to technology, self-efficacy, and a sense of belonging, the program has achieved measurable success across multiple cohorts. The findings highlight the importance of creating supportive academic and professional environments to empower underrepresented students to excel in STEM fields.

To build on this success, several recommendations are proposed. First, mentorship opportunities should be expanded by engaging more industry professionals, providing diverse perspectives, and enhancing career readiness. Second, variability in technology access must be addressed by ensuring consistent resources for all participants, enabling full engagement with the program. Third, faculty training on culturally responsive teaching practices should be enhanced to further improve inclusivity and support for a diverse student body. Lastly, implementing robust feedback mechanisms to continuously gather and analyze participant input will help refine program components and ensure sustained, long-term impact.

Acknowledgment

We thank Reboot Representation Tech Coalition for their support in advancing diversity in tech. Their funding and partnership have been key to LIFT's success, aligning with their goal of doubling Black, Latina, and Native American women in computing by 2025—a milestone reached early [21]. Their contribution fosters a more inclusive, skilled workforce. In addition, this material is based upon work supported partially by the National Science Foundation Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program under Award No. 2220260. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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