

# **Bridging the Gender and Skills Gaps with Emerging Technologies**

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Dr. Billionniere is a Senior Associate Professor in the School of Engineering and Technology at Miami Dade College (MDC), where she leads the Cloud Computing Literacy Initiative. She has helped MDC secure over \$3 million in federal funding the past three years for STEM and emerging technology education program. Dr. Billionniere's leadership and mentoring have been celebrated and recognized, most recently with the 2021-2023 The Northern Trust Bank of Florida Endowed Teaching Chair and 2019 Women of Color STEM's College-Level Promotion of Education Award.

## **Farzana Rahman**

Dr Farzana Rahman is an Associate Teaching Professor at the EECS department of Syracuse University. Her research spans the domains of mobile healthcare, healthcare data analytics, and pervasive health technologies. Broadly, my research focuses on integrating mobile and pervasive technologies in health and wellness environments to improve users' quality of life, mental and physical wellbeing. My research also expands in the direction of mobile security, information and communication technology for development (ICT4D), broadening participation in CS/ IT discipline through the exploration of 1) discipline-based education research to inform pedagogical practices that garner interest and retain women and minorities; 2) success factors contributing to the persistence and success of students (both traditional and non-traditional) in introductory programming courses; 3) how different pedagogical practices can increase underrepresented student performance in CS/IT courses; 4) factors of success impacting student performance in online and inverted classrooms within computing majors and 5) how effective re-entry pathways can facilitate transition of returning women in computing based discipline.

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## **Abstract**

The number of jobs in the United States requiring substantial Science, Technology, Engineering, and Mathematics (STEM) expertise has grown nearly 34 percent over the past decade and employers say they are having trouble filling jobs in occupations that depend on skilled technical professionals. Women, specifically adult women, are a pool of talented individuals who can fill STEM jobs nationwide. With the support of National Science Foundation (NSF), the project team designed, developed, organized, conducted, and evaluated a conference supporting the re-entry of adult women in emerging technology (EmTech) fields, such as cybersecurity, data science, artificial intelligence, and cloud computing.

In this poster, we summarize the key findings pertinent to overall conference satisfaction and impact, reasons for educational and career breaks, and mitigating barriers for (re-)entering academia and workforce in the computing disciplines. These results are presented to provide insights and give a voice to adult women in tech to build capacity and broaden participation in the computing field through upskilling and reskilling with the emerging technology gateway.

## **Introduction**

COVID-19 has added to the industry's gender and ethnic underrepresentation issues. The pandemic's reallocation shock has caused more than 31 million Americans to rely on unemployment [1]. As the pandemic continues to sharpen inequalities in America's economy, nearly eight times the number of women left the workforce compared to men this year. These rates were higher for women of color [2]. Women are three times as likely to take on household chores/childcare, and as a result have left their career to attend to virtual learning and other pandemic curveballs [2].

To broaden participation and fill a growing need for workers in computing, it is important to consider innovative pathways that delve into untapped pools of talent for training and recruitment. It has been estimated that by 2030, approximately one-third to a half of employees may desire new occupations or may need to either reskill or upskill [3]. Some niches within the STEM fields, like EmTech, are expected to grow job opportunities more quickly than others [4, 5]. The demands of these jobs can only be fulfilled by creating opportunities for one of the largest untapped STEM talent pools: returning women. Part of the solution is a need to build effective re-entry educational and workforce pathways specific to the needs of returning women for a fast-changing future requiring upskilling and reskilling [6].

## **Background**

The NSF RESET 2021 conference was designed to support the re-entry of women in EmTech fields with the goal to explore and discuss challenges encountered by returning women for better understanding their situations and identifying solutions to their problems in accessing EmTech education and employment. From this goal, three objectives were pointed out: (1) Identify the barriers for returning women to enter EmTech education and workforce; (2) Inform best

practices to create effective re-entry strategies in EmTech for returning women; and (3) Connect with scholars, policy makers and leaders to make change in EmTech.

Due to the COVID-19 pandemic, the conference was fully online with 38 sessions, 63 women speakers across the industry sectors, 444 women registrants across the world including 216 student participants, and 2,125 total views across all the sessions. This was a tech conference for women by women.

## **Methodology**

The NSF RESET conference was evaluated using both quantitative and qualitative methodology. The evaluation of the conference included three main data collection components: 1,360 post-session survey responses across all conference sessions; 161 post-conference responses; and four focus groups with 18 volunteer participants in total to discuss further their experience attending the conference and their perspectives on career breaks for women in technology fields. The evaluation focused on event satisfaction, understanding the challenges and barriers women face when returning to the workforce or academia after a career break, and recommendations for improving the transition.

## **Outcomes and Discussions**

### *Identify the barriers for returning women to enter EmTech education and workforce*

The top three reasons why women may not re-enter computing education reported by survey respondents were family obligations (46.5%), stereotype threat of computing and tech-based industry (38.85%), and a lack of knowledge about diverse pathways (37.58%). Women who participated in focus groups reported that family obligations were a common cause for women who took breaks from educational pathways in tech industries. Additionally, when returning to school after a prolonged break, they had to relearn how to be students and how to study. Others explained that, particularly for women, there is a negative perception about STEM education and how to succeed in this field of academia.

Post-conference survey respondents reported the top three reasons why women may not re-enter computing and tech careers included stereotype threat of computing and tech-based industry (49%), lack of re-entry programs (returnships) (44%), and lack of supportive community/network (43%). Women in the focus groups reported that they struggled with being perceived as qualified, or perceiving themselves as qualified, for the jobs they are applying for after a career break. Conference participants expressed that woman seeking jobs often pursue openings for which they meet all the qualification requirements, whereas their male counterparts may not hold themselves to the same standard. Similarly, focus group participants reported that they struggled with how to explain career breaks or changes in career on their resumes, and that in some cases the resume screening software that many companies use will reject resumes due to that gap. During focus groups, participants cited the lack of flexibility in work schedules as a barrier for women who have familial obligations. Focus group participants also noted that racism, sexism, and ageism may be barriers for women reentering STEM careers.

*Inform best practices to create effective re-entry strategies in EmTech for returning women*

Several key suggestions were proposed across focus group respondents and survey respondents who provided feedback on the ways in which academia and industry could create a smoother transition for women entering or re-entering computing or technology fields of study. Common themes in responses are provided for each suggestion in Table 1.

Table 1. Suggested Strategies and Actions to Mitigate Barriers

| Academia                                                 | Industry                                                                   |
|----------------------------------------------------------|----------------------------------------------------------------------------|
| Provide flexibility in course scheduling                 | Increase flexibility in work environment                                   |
| Increase pathway offerings in computing/EmTech education | Instill a willingness to take a chance on less-traditional candidates      |
| Create more connections with industry partners           |                                                                            |
| Provide more mentoring                                   | Provide more mentorship and at-work advocates for women                    |
| Improve student culture for women                        | Drive a company culture change                                             |
| Offer more support, like scholarships, to women          | Create returnship and apprenticeship opportunities for on-the-job learning |

There are many similarities – such as flexible schedule, mentoring, resources, and culture of change – that could be implemented through academia-industry partnerships for returning women who are either currently employed and going back to school or currently enrolled in school and seeking employment.

*Connect with scholars, policy makers and leaders to make change in EmTech*

Nearly 95% of respondents reported that they would recommend the resources provided through the conference to their peers. 116 conference attendees also reported on the most important benefits that they gained from attending the NSF RESET conference. Their responses fell into three common themes: 1) a network of women to support them; 2) inspiration as they continue their career paths; and 3) knowledge and practical information. Sample responses representative of each of them included:

- “A network of encouraging and bold women from all over the country who are racially and culturally diverse.”
- “The most beneficial was being able to see that I am surrounded by many women who share my same thoughts and fears and I have the support to continue.”
- “I am not alone. Many women have faced the challenges of being a working mom and have thrived. I am really thankful for seeing mothers with their PhDs and other moms pursuing tech careers despite the obstacles they faced.”
- “Attending the NSF RESET has allowed me to gain much more confidence in myself.”
- “The path to employment in the tech field is open to nontraditional students like me.”
- “I learned about additional learning and hands-on training resources which will be beneficial in advancing my skills.”
- “The most important benefit was learning to tie in technical and soft skills into my past roles so that I can hit the brief of what the potential employer is looking for.”

Similarly, at least three-quarters of post-conference survey respondents reported benefits of attending the NSF RESET conference that aligned with the same three themes: inspiration, networks of support, and skills/knowledge acquisition. Respondents most frequently agreed that they had gained new skills or information that will help them advance their careers (87%), felt more inspired about the opportunities ahead of them (85%), and increased their network (78%).

## **Conclusion & Future Work**

Overall, the NSF RESET conference met its three objectives, and those who attended the conference were very satisfied (95%) with the event itself, the ways in which it empowered them to think more proactively about barriers for women re-entering computing through EmTech fields and how to mitigate them, and the key learnings that they took from the conference. More than three-quarters of attendees (78%) reported that they felt more prepared to pursue a future in computing than they did before they attended the conference. Finally, attendees reported that the conference, the presenters, the networks established, and the knowledge they gained from the sessions will benefit them as they continue to pursue education and careers in computing and technology fields moving forward.

One important future research direction can be to follow up with conference attendees to evaluate and assess long-term impacts of the conference materials, resources, and community connections on their efforts to pursue, persist, and prevail in computing/EmTech education and career.

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