

NSF RESET: A Conference to Support Returning Women's Transition to Computing and Technology Discipline

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Abstract

The disparity of women in STEM (Science, Technology, Engineering, and Mathematics) discipline have been a persistent problem in the United States of America. Research suggests that women who join STEM discipline leave very frequently to care for their families, financial setbacks, personal obligations, and call to active-duty program. Returning women, very rarely choose to pursue STEM education or cannot enter the STEM workforce because - 1) these fields are constantly evolving; 2) the technical preparations can be challenging or unknown; 3) technical skills development require a lot of time and effort; 4) there are not enough transitional programs which can leverage the existing background of returning women to develop new knowledge; and 5) industry and academia do not have enough knowledge to create diverse reentry pathways to prepare returning women for the 21st century workforce environment. Some niches within the STEM field, like Emerging Technology (EmTech) concentrations (e.g., cybersecurity, data science, artificial intelligence, and cloud computing), are expected to grow job opportunities more quickly than others. The demands of these jobs can only be fulfilled by creating opportunities for one of the largest untapped talent pools, which is returning women.

Therefore, to understand the barriers and challenges faced by returning women to enter computing and tech education and workforce, a three-day virtual conference, RESET (Re-enter STEM through Emerging Technology), was organized in March 2021. Through our experience in organizing a large-scale national conference, we surveyed 444 attendees (conference organizers and participants) to investigate their level of satisfaction and the overall effectiveness in helping returning women facilitating their transition to computing and technology discipline. In this paper, we present the qualitative and quantitative results on conference attendee's satisfaction level and its effectiveness in identifying appropriate resources to (re-)enter EmTech educational and professional pipeline.

Introduction

One of the critical needs of the 21st-century workforce development is the recruitment, retention, and graduation of women in computing and technology fields. In computing discipline, only 22% of the bachelor's degrees were awarded to women, down from a high of 28% in 2000 [1]. Even though there are many national and regional initiatives focused on computing education, out of the small number of women in computing disciplines, many leave their education or profession very frequently, according to National Center of Women and Information Technology (NCWIT) [2]. According to the NCWIT, 56% of women with a technical education leave the workplace at the 'mid-level' point, majority never return to workforce [3].

Additionally, the COVID-19 pandemic has affected nearly all the aspects of society since its onset in early 2020 and its attack on the labor market has impacted millions of women who have either lost jobs or left workforce voluntarily due to many unprecedented circumstances [4]. As the COVID-19 pandemic continues to spread its impact in the workforce, women all over the world are disadvantaged to a significantly greater extent [9]. Women who are now making their comeback to the workforce are also struggling to find appropriate jobs that suit the demand and need of their life. However, returning women, very rarely choose to pursue computing education or cannot get into the computing profession due to various reasons [5-7]. Hence, they remain to be one of the largest untapped talent pools in the nation [8]. The field of computing and tech can use this untapped potential to fill the gap in job sector, which is growing at a rapid rate, yet, very few returning women join those fields due to many structural barriers, lack of upskilling, and reskilling opportunities. Additionally, some niches within the computing field are expected to grow job opportunities more quickly than others. Emerging Technology (EmTech) fields like cybersecurity, data science, mobile development, machine learning, and cloud computing will have thousands of jobs in the next decade which will require a large pool of technical people [10, 11]. It is timely, and perhaps imperative to build the capacity of returning women by enabling them to (re-)enter computing and tech education and professional pipeline.

Therefore, to broaden the participation and to fill the gap in computing workforce with skilled returning women, a national virtual conference, NSF RESET (Re-entering STEM through Emerging Technology), was organized in 2021 in the midst of the COVID-19 pandemic. Through RESET conference, we tried to investigate and understand the barriers and challenges faced by returning women to (re-)enter computing and technology-based disciplines. The goal of the conference was to provide a platform to share experiential knowledge and evidence-based findings, and to provide comments and suggestions about how the enrollment, retention, recruitment, and employment opportunities of returning women may be improved through different efforts like research, practice, policy, and evaluation. As a result of the conference, the advisory board and organizing team developed actionable recommendations for actions that industry, academia, non-profit, policymakers and government agencies, can take to strengthen the pipeline for (re-)entering into computing and technology domain [11-15]. In this paper, we present the qualitative and quantitative results on conference attendee's satisfaction level and its effectiveness in identifying appropriate resources to (re-)enter EmTech educational and professional pipeline.

Objectives and Design of the Conference

In this section, we briefly discuss the objectives, design rationale and outcome of the conference.

Conference Objectives

The goal of the NSF RESET conference was to explore and discuss challenges encountered by returning women with the goal of better understanding their situations and identifying solutions to their problems

in accessing computing and tech education and employment opportunities. In Figure 1, we highlight the conference's three primary goals:

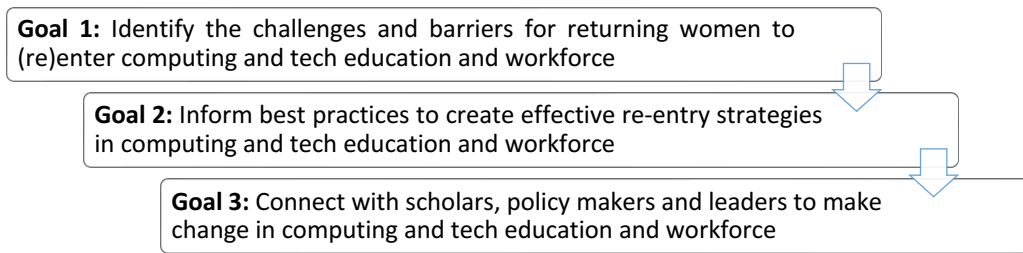


Figure 1 Goals of the conference

The conference also provided a platform to share experiential knowledge and evidence-based findings, and to provide comments and suggestions about how the enrollment, retention, recruitment, and employment opportunities of returning women may be improved through different efforts like research, practice, policy, and evaluation. Hence, the goals identified above position the conference as both evidenced-based and evidence-generating in the quest to finding new success strategies for returning women to (re-)enter computing and tech discipline.

Conference Design Rationale

The national virtual conference, RESET, was designed to understand the barriers and challenges faced by returning women to (re-)enter computing and tech education and career path. The conference was designed to provide:

- (a) a platform that supports collaborative discussion on effective strategies having a real impact on bringing more returning females in computing and tech fields
- (b) a platform to explore and identify barriers and challenges for returning women to enter computing and tech
- (c) to foster knowledge on what strategies do returning women currently utilize to enter the educational and professional pipeline of computing and tech disciplines
- (d) knowledge to participants on existing programs, career options and skill building opportunities on computing and tech degrees and profession
- (e) a community to exchange new ideas and innovations to enable returning women's re-entry in computing and tech disciplines
- (f) a networking community of educators and industry professionals to facilitate greater dissemination and exchange of expertise, which can generate effective and innovative pathways for returning women's re-entry in computing and tech disciplines

Conference Outcomes

The virtual conference NSF RESET have utilized Whova [16] conference management system which allowed participants to experience enhanced interaction and engagement during and after the conference. The conference also provided a companion mobile application, facilitated by Whova, for all participants to allow user mobility during the 3 days of the virtual conference. RESET conference hosted 38 sessions spread in 3 consecutive days.

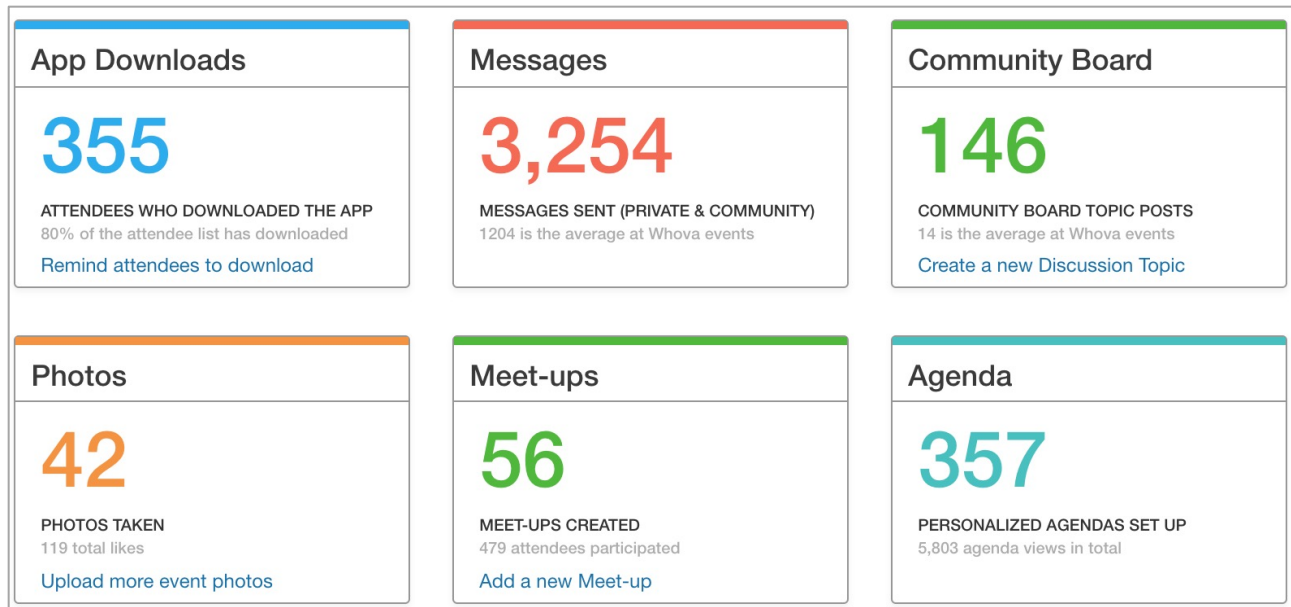


Figure 2 Interaction statistics during RESET

There were 444 registrants for the conferences where 62 speakers either participated in a panel, presented a research study through an individual talk, or facilitated a hands-on technical workshop. Out of the 444 registrants, 216 participants were students in the computing/IT related field. In total there were 127 student scholars, 12 faculty scholars, 107 Non-Student General Attendees, 76 Student General Attendees, 62 Speakers and close to 60 attendees in other categories. The entire virtual conference sessions had 2,125 view count which is an indication that the sessions were highly popular (See Fig. 2).

Due to the virtual platform, the community board of the conference facilitated 2,989 messages among its attendees. The agenda page of the conference was viewed 489 times. The main conference website [17], was viewed 1613 times since May 2021. To disseminate and publicize the NSF RESET Conference, it was shared in 19 different Facebook groups related to women in tech, women in computing, returning techies, non-traditional techies, and various IEEE and ACM Women centric groups. The hashtag for NSF RESET conference is #NSFRESET21, were shared for close to 38 times within LinkedIn Platform and 49 times in Twitter platform (See Fig. 3). The NSF RESET conference has a dedicated twitter profile which periodically shared scholarship announcements, call for participation, speaker details, website details, conference outcomes were shared though this account for close to 30 times. The overall interaction report of the RESET conference confirms that the participants experienced elevated engagement even though it was a virtual conference.

Study Design and Methodology

One metric we utilized to evaluate the conference was to measure participant satisfaction and their agreement to recommend RESET resources to peers and in their respective communities. In this section we briefly discuss the methodology to measure the above two metrics, data collection process and design principle of the evaluation study.

Data Collection

The study methodology included three main data collection components: post-sessions surveys for all conference sessions; a post-conference session; and focus groups with volunteers to discuss their experience attending the RESET conference; and their perspectives on career breaks for women in

computing and tech fields. The evaluation focused on event satisfaction, understanding the challenges and barriers women face when returning to work or education in computing and tech after a career break, and recommendations for improving the transition. The number of participants included in each of the data collection sources are provided in Table 1.

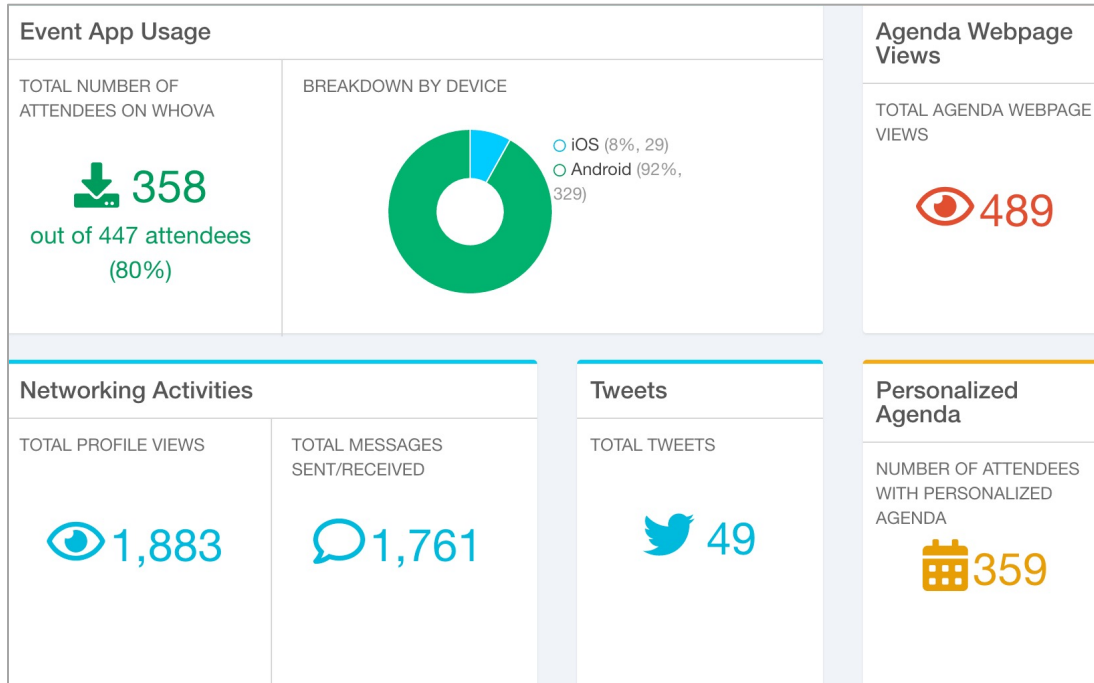


Figure 3 Social media presence and engagement statistics during RESET

Table 1. Participation in data collection for RESET Conference

Data Collection	Number of Participants
Post-Session Surveys	1360 responses
Post-Conference Survey	161 attendees responded
Post-Conference Focus Groups	18 attendees participated

Survey Instrument

The main contribution of this paper is a summary of participant satisfaction and effectiveness in reaching the conference goal, conducted based on the post-conference survey. The post-conference survey was administered to all 444 attendees at the end of the conference. 161 attendees provided feedback on the post-conference survey. To develop the survey, the evaluation team first referenced priorities and goals of the surveys discussed during the project launch, reviewed the evaluation questions in the project narrative, and mapped the evaluation questions with the overall research questions of the project. A general inductive approach was used to analyze the qualitative data generated from the survey. This approach was selected because it is particularly useful in drawing clear links between research questions or objectives and data collection results. Thematic analysis was conducted for open-ended responses.

The surveys were closed two days after the conclusion of the conference. Once the surveys were closed, data was exported from the software into Excel for analysis. Frequencies (i.e., the number of times a value

occurs) and percentages were identified for closed-ended responses. Once the analysis was completed, a summary report was developed for each session. All open-ended responses were included.

The entire post-survey consisted of three demographic questions, five Likert questions, 34 other questions that asked participants to report their current academic concentration, if they had any career break, if they have (re-)entered computing and/or tech education or professional pipeline, what challenges and barriers they faced and what strategies have been useful for them to reskill or upskill so they could (re-)enter. In the post-survey, of the 161 attendees who responded to the survey, two-thirds (67.74%) were undergraduate students, 12.50% were graduate students, and 8.55% were faculty members. All respondents were women (100.00%) with just over half (55.26%) under the age of 30, and one-quarter (26.97%) reported that they had experienced a career break.

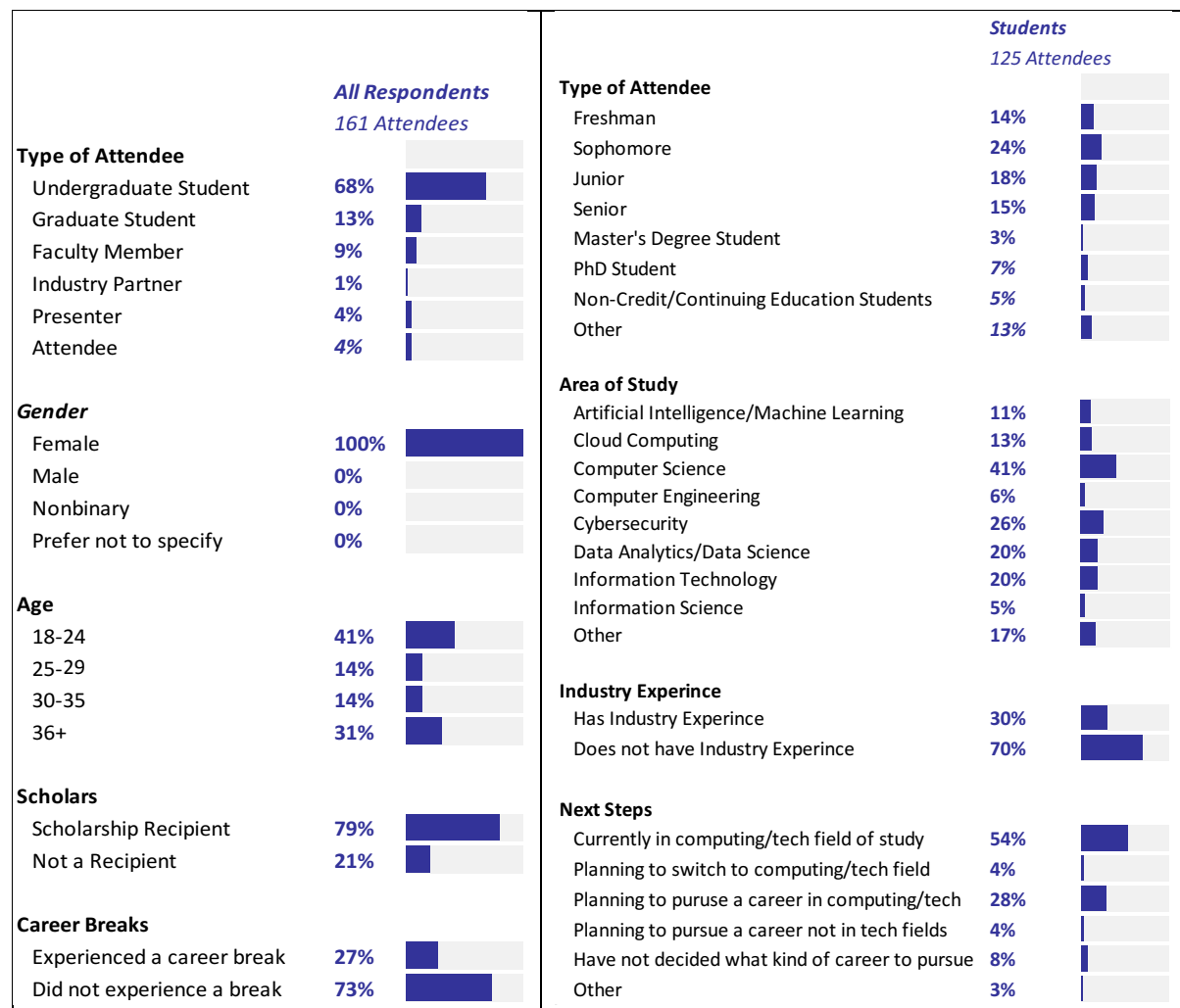


Figure 4 Demographics of participants at RESET

Study Results

Demographic of the Participants

Close to 80% of the participants were students, where nearly three-quarters of the 125 students who responded to the survey were underclassmen (72.00%), and the most frequently reported areas of study for respondents were Computer Science (41.00%), Data Analytics (20.00%), and Information Technology

(20.00%). All 100% participants were student women, and the largest population were from an age group of 18-24, with second largest being women who were 36 years or older (See Fig. 4).

Conference Satisfaction

Overall, conference attendees were satisfied with the NSF RESET Conference. 95.03% of attendees reported that they were somewhat or very satisfied with the conference. Of those, nearly 85% (84.847%) reported that they were very satisfied (See Fig. 5). Open-ended survey responses reflected this positive assessment of the conference, and these responses are provided throughout the findings in the report.

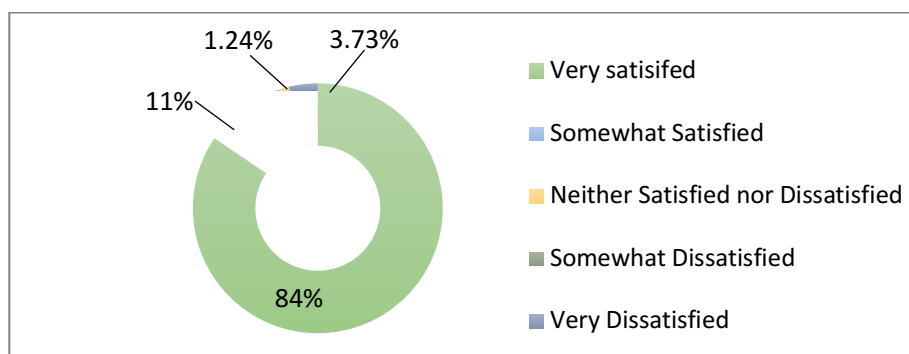


Figure 5 Overall Conference Satisfaction (n = 161)

Additionally, conference attendees were satisfied with the sessions they attended. 27 of the 31 sessions that attendees completed post-session surveys for had a satisfaction of rate of 90.00% or greater. Additionally, six of the conference sessions has 100.00% satisfaction rates: Exploration of Intersectionality and Computer Science Demographics: Understanding the Context of Shifts in Participation; EmTech Education and Skills; Training the Trainers: Faculty Professional Development for Newer Programs in EmTech; Non-Profit Organizations Role in Diversifying the Future Tech Workforce; Google #IamRemarkable; and Secure and Privacy-Preserving Data-Driven Systems.

Among the participants, varying levels of satisfaction were reported by participants of different career levels, highest satisfaction was reported by undergraduate students (approximately 90%), which was followed by grad students, faculty members and industry professionals (50%) (See Fig. 6).

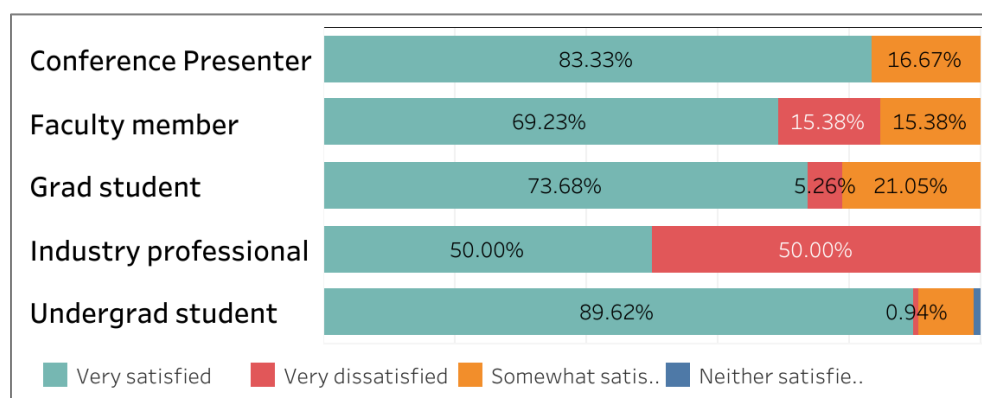


Figure 6. Conference satisfaction level of participants of different career level

Forty-one respondents (26.97%) reported that they had experienced career breaks. Of those, 43.90% reported that their break was less than two years. Most of these participants had at least some college education before their break (87.82%) and were working or both working and in school before their break

(87.81%). More than half of those who experienced career breaks (63.63%) found a job in computing/tech field in less than a year after their break started.

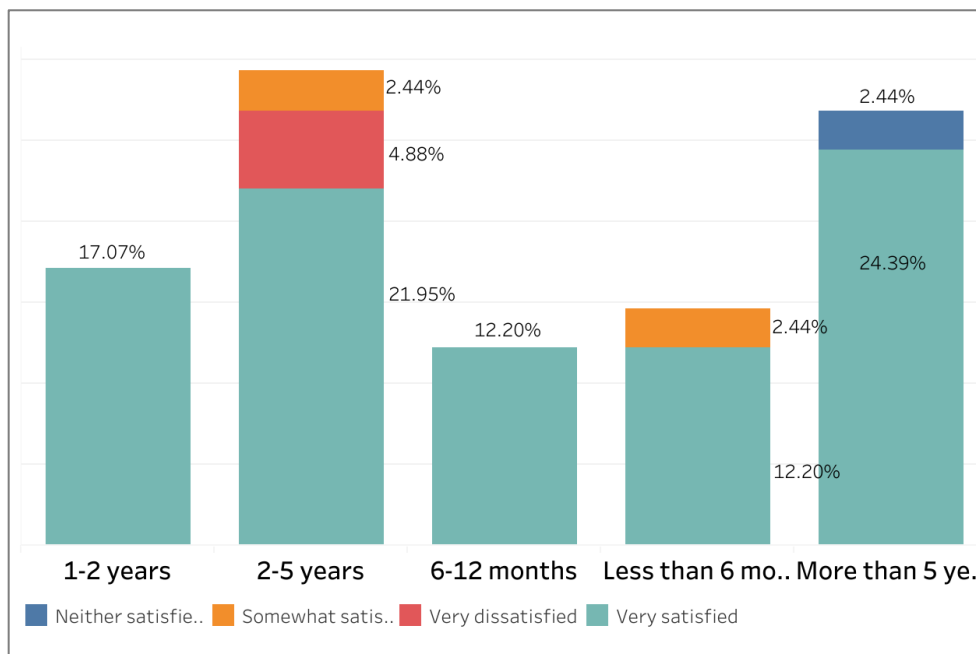


Figure 7. Conference satisfaction level of participants with different duration of career break

Among the participants with career break, highest satisfaction level was reported by women who had more than 5 years of career break (approximately 25%), which implies that the resources offered by the RESET conference were valuable to women with career break (See Fig. 7).

Among the participants from various age group, highest satisfaction level was reported by two groups (18-24) and (over 36) (See Fig. 8). A cross section analysis also confirms that 38% of these reporters experienced over close to 2 years of career break which again confirms the usefulness of resources offered by RESET.

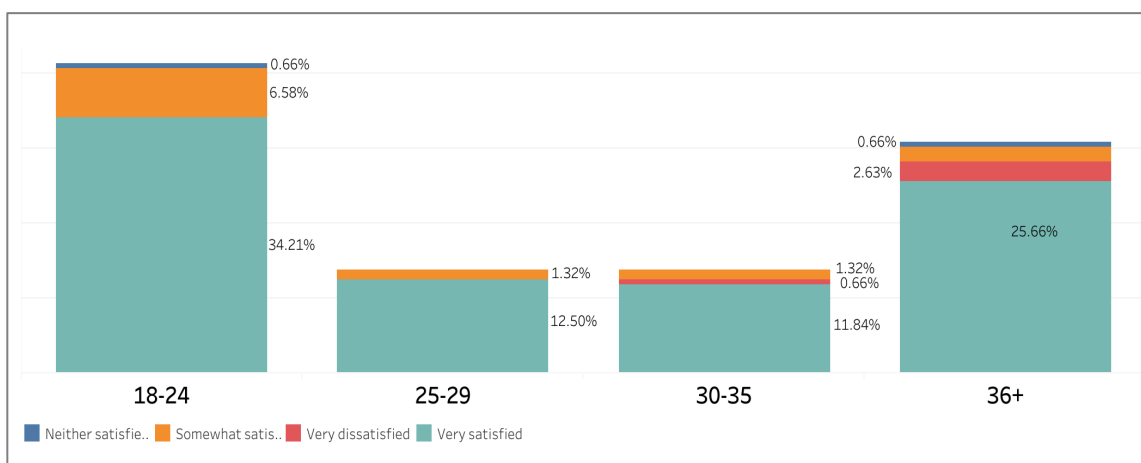


Figure 8. Conference satisfaction level of participants from different age group

Nearly two-thirds (63.17%) reported an area of study related to computing/tech. Most students did not have any industry experience in computing or technology fields (69.60%). Half of the students (53.61%) reported that they are currently in a computing or tech field of study, and more than one-quarter (28.31%)

reported than they plan to pursue a career in computing or tech fields. Almost all participants having a background in computing or closely related discipline have reported to be highly satisfied with the conference (over 90%) (See Fig. 9).

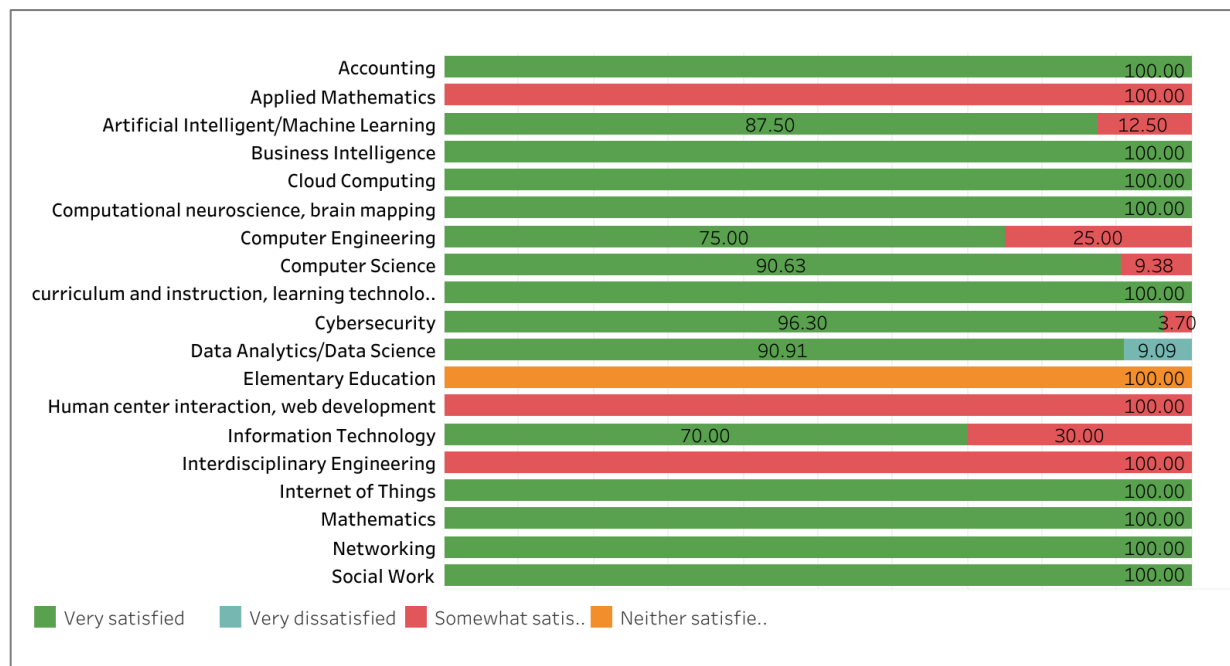


Figure 9 Conference satisfaction level of participants from different technical background

All respondents reported that they learned at least some of what they had hoped to learn at the NSF RESET Virtual Conference, and 83.23% of respondents reported that they learned what they hoped to at the conference (See Fig. 10).

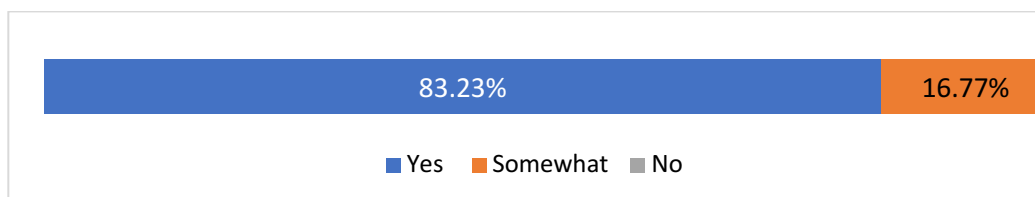


Figure 10 Respondents Learned What They Hoped to Learn (n=161)

Respondents who reported that they learned what they hoped to at the conference expressed that they hoped to learn about “advances in technology and the tech field,” “opportunities for women in STEM,” “how to better navigate the tech field as a woman,” and “I was hoping to learn about other women’s experiences in the STEM field.” For respondents who reported that they learned some of what they had hoped to at the conference, they responded with similar hopes for the conference, and also added that they hoped to learn “specific practices individual faculty can use to make their classes more inclusive, mentoring strategies, etc.,” and “I was hoping to learn more practical skills.”

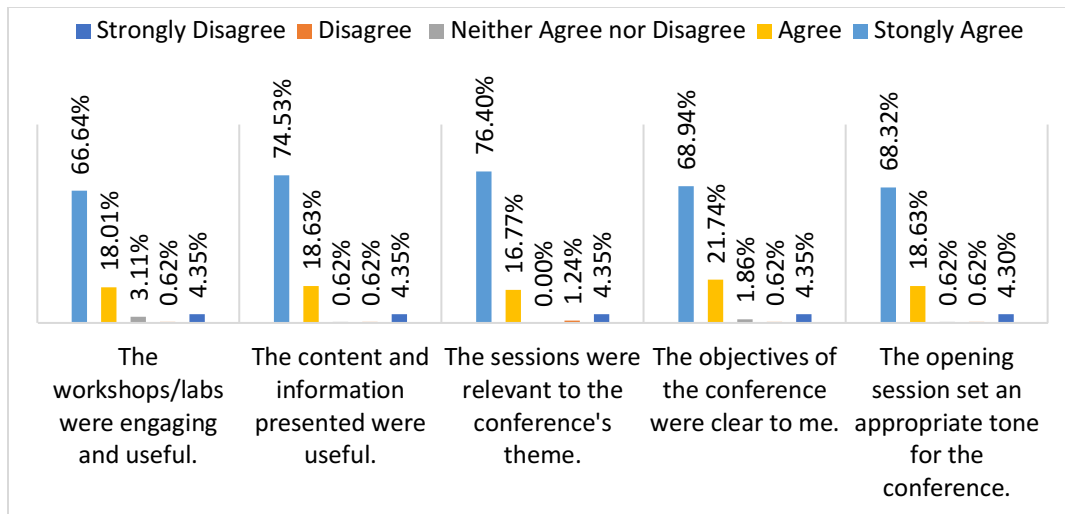


Figure 11 Respondents' Level of Agreement with the Following Statements (n=161)

Nearly 85.00% of respondents agreed with the statements related to the overall NSF RESET Conference's structure and content, and less than 10 respondents (>5.00%) disagreed with each statement (See Fig. 11). One respondent noted, "This was one of the best conferences I have attended. The enthusiasm was overwhelming. Attendees wanted more and were very grateful [...]!" Another echoed, "The conference was well planned and organized. I enjoyed the workshops and learned a lot from the speakers. I particularly liked the diversity of institutions represented and expertise shared." Several respondents noted that the speakers were engaging as one explained, "The speakers were very candid and engaging which made this virtual experience have life."

Future Uses of NSF RESET Conference Content and Resources

Nearly 95% of respondents (94.77%) reported that they would recommend the resources provided through the conference to their peers. Only seven respondents reported a neutral or negative response to sharing the resources provided. 116 conference attendees also reported via the survey on the most important benefits that they gained from attending the RESET Conference (See Fig. 12).

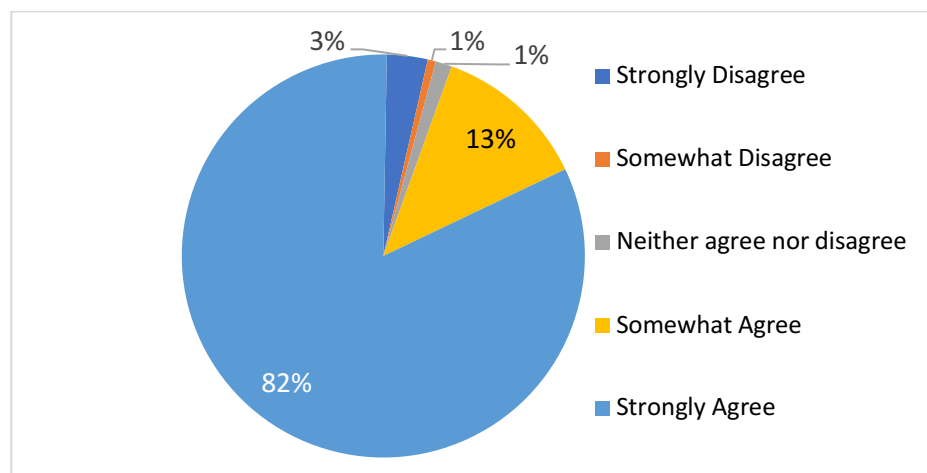


Figure 12 Recommending RESET Resources to Peers (n=153)

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:

Network of Support (~30% responses):

- “Knowing there are a lot of other women in the same situation and that together we can learn to help each other thrive.”
- “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.”

Inspiration (~25% responses):

- “Attending this RESET has allowed me to gain much more confidence in myself.”
- “There are so many. Know my worth. Bring my A game. How to stand out as a candidate for a job and excel at the interview.”
- “Hearing other women's stories of how they came to be where they are was very inspiring. I feel like I don't actually have to hide my arts background and that some employers might find it a good thing.”
- “The path to employment in the tech field is open to nontraditional students like me.”

Knowledge and Practical Information (~23% responses):

- “Attending RESET, I gained more insight and knowledge of things I did not know about before.”
- “I learned about additional learning and hands-on training resources which will be beneficial in advancing my skills.”
- “I gained a lot of applicable knowledge in regard to transitioning from school to career.”
- “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.”

Discussion and Conclusion

Overall, the NSF RESET Conference was highly successful in meeting its primary goals. The conference was able to 1) offered platform for returning women to discuss the challenges face as they are navigating navigate their way back to computing and tech domain, 2) facilitate discussion among women to create a network and support group, 3) provided useful resources for returning women to help them enhance their skills, and 4) offered useful strategies their professional and academic career development. This was evident since all data analysis confirms that majority of the conference participants were highly satisfied with the RESET conference. Those who attended the conference were very satisfied with the event itself, the ways in which it empowered them to think more proactively about barriers for women (re-)entering STEM and tech fields and how to mitigate them, and the key learnings that they took from the conference. 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.

Acknowledgements

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References

- [1]. Science and Engineering Indicators 2018, State Indicators. Alexandria, VA: National Science Foundation (NSB-2018-1). URL: <https://www.nsf.gov/statistics/2018/nsb20181/>
- [2]. Women in Tech: The Facts (2016 Update). URL: <https://www.ncwit.org/resources/women-tech-facts-2016-update>
- [3]. STEM 2026: A Vision for Innovation in STEM Education. URL: https://innovation.ed.gov/files/2016/09/AIR-STEM2026_Report_2016.pdf
- [4]. U.S. Department of Labor. *Covid-19 Impact*, 2020, [Online]. Available: <https://www.dol.gov/sites/dolgov/files/OPA/newsreleases/ui-claims/20201453.pdf>
- [5]. J. Clark Blickenstaff. "Women and science careers: leaky pipeline or gender filter?." Gender and education Vol.17, No.4. 2005
- [6]. C. Hill, C. Corbett, and A. St Rose. "Why so few? Women in science, technology, engineering, and mathematics." American Association of University Women. 2010.
- [7]. National Research Council. Women Scientists and Engineers Employed in Industry: Why So Few? National Academies Press. 1994.
- [8]. F. Kapor Klein. "Giving Notice: Why the Best and the Brightest Leave the Workplace and How You Can Help Them Stay." San Francisco: John Wiley & Sons. 2008
- [9]. A. Tappe. "A Shocking Number of Women Dropped Out of the Workforce Last Month". 2020. [Online]. Available: <https://www.cnn.com/2020/10/07/economy/women-workforce-coronavirus/index.html>
- [10]. R. Rawlings-Goss. "Data Science Careers, Training, and Hiring." Springer International Publishing, 2019.
- [11]. N. Soni, E. K. Sharma, N. Singh and A. Kapoor. "Artificial Intelligence in Business: From Research and Innovation to Market Deployment." Procedia Computer Science, 2020, Vol. 167. <https://doi.org/10.1016/j.procs.2020.03.272>
- [12]. F. Rahman, E. Billionniere, B. Marshall, H. Seo and T. Forman. "Debugging the Diversity Tech's Gap through (Re-)entry Initiatives in Emerging Technologies for Women." Proceedings of the 52nd ACM Technical Symposium on Computer Science Education, 2021. <https://doi.org/10.1145/3408877.3432563>
- [13]. F. Rahman & E. Billionniere. "Re-Entering Computing through Emerging Technology: Current State and Special Issue Introduction." ACM Transactions on Computing Education, Vol. 21. 2021, <https://doi.org/10.1145/3446840>
- [14]. F. Rahman, E. Billionniere, A. Q. Gates, and F. Stukes. "Equipping and Empowering Faculty through Professional Development to Create a Future-Ready Workforce in Emerging Technologies." Proceedings of the 22st Annual Conference on Information Technology Education, 2021.
- [15]. E. Billionniere, F. Rahman, Q. Brown and H. Seo. "Role of Academia to Create Re-entry Pathways in Computing." Proceedings of the 5th IEEE Research on Equity and Sustained Participation in Engineering, Computing, and Technology. 2020.
- [16]. Whova, <https://whova.com/>
- [17]. NSF RESET Conference 2021, <https://resetconference.syr.edu/>