Analyzing the Impact of Attending a Women in Computing Conference on Undergraduate Computing Students

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Mary V. Villani is an Associate Professor at Farmingdale State College (FSC). She holds a doctoral degree from Pace University, the Ivan G. Seidenberg School of Computer Science, and Information Systems. Her dissertation topic was Keystroke Biometric Identification Studies on Long-Text input. Publications in this area include peer-reviewed journal articles, external conference papers and a co-authored book chapter in Behavioral Biometrics for Human Identification: Intelligent Applications. Dr. Villani has been actively seeking funding and has been awarded funding both internally and externally to address the gender disparity in the Computing Programs at FSC and is Co-Faculty Advisor to the Supporting Women in Computing Club. Dr. Villani has presented and published in peer reviewed journals regarding initiatives and outcomes addressing the gender disparity in computing disciplines including co-moderated a Birds of a Feather Session at the virtual NY Celebration of Women in Computing at the Spring 2021 Conference entitled: Learning and Sharing from the Decade long Journey of Success and Failures on Women in Computing Initiatives. Professor Villani presented a paper entitled, Solving the Gender Disparity Puzzle in Computing Disciplines at a Commuter State College at ISECON virtual conference in October 2021 and co-moderated a Birds of a Feather session at SIGSCE 2022 virtually entitled: Mentoring a Women in Computing Club: The Good, The Bad and The Ugly. Dr. Villani presented a paper at ASEE 2022 in Minneapolis, MN entitled: Designed A (Re)Orientation Program for Women Computing Students at a Commuter College and Measuring its Effectiveness. Fall 2023 a paper entitled: An Early Measure of Women-Focused Initiatives in Gender-Imbalanced Computing programs were presented at CCSC Eastern Conference. Dr. Villani has been a Grace Hopper Scholarship reviewer, Dr. Villani was awarded the Chancellor's Award for Teaching Excellence in 2013. Prior to joining FSC, Dr. Villani had a fifteen-year Computer Consulting Career in the Risk Management and Insurance industry. Throughout her career, she wrote articles and papers on the topic of Risk Management Information Systems and delivered several invited presentations at Risk Management Conferences as she was a recognized expert in the discipline.

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Ilknur Aydin is an Associate Professor of Computer Systems at Farmingdale State College in New York. She received her Ph.D. in Computer Science from University of Delaware in DE, USA and received her BS degree in Computer Engineering from Marmara University in Istanbul, Turkey. She also worked as a software engineer in Turkey on projects about implementation of a GPS (Global Positioning System) based vehicle tracking system.

Dr. Aydin's research is in the general area of wireless and mobile networks with a focus on transport layer issues including multihoming, SCTP, congestion control, and network coding. Dr. Aydin has mentored undergraduates and high school students on research projects that involve the use of Arduino boxes and Raspberry Pi's in the context of Internet of Things.

Dr. Aydin has been a vivid supporter of women in computing and increasing diversity in computing. She has been the co-faculty advisor for Women in Computing club at Farmingdale, contributed in Grace Hopper Celebration as a technical committee member and reviewer. Dr. Aydin has published and presented in peer reviewed venues about women in computing and broadening the participation over a decade.

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Lisa Cullington, Ph.D. is an educational researcher with expertise in curriculum development, learning outcomes and educational assessment best practices. She focuses on building and evaluating academic programs that promote inclusive excellence for all learners. Currently, Dr. Cullington serves as the Director of Learning Outcomes for National University. Previously, she was the Founding Co-Director of the Honors Program at SUNY Farmingdale and Associate Director of the Research Aligned Mentorship (RAM) Program where she designed, implemented, and evaluated academic programs to engage students

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Abstract

Undergraduate computing degrees have long experienced a gender disparity in enrollment. Research shows that a lack of sense of belonging can negatively impact underrepresented students in higher education, and in the STEM fields. Furthermore, academic self-concept has been demonstrated to support students in persisting and graduating college. However, it is unclear how colleges can utilize interventions to cultivate a sense of belonging and academic self-concept specifically for women in the computing field. Furthermore, research is needed to understand the impacts of career focused academic conference participation for women enrolled in undergraduate computing degrees at commuter institutions. This study examines the impact of participating in a regional Women in Computing conference on their sense of belonging and academic self-concept. This study utilized a quantitative, descriptive approach to examine the experience of 29 undergraduate women interested in the computing field at a teaching college, public institution in NY State. Participants participated in a pre- and post-conference survey to determine the perceived impacts. Participants were also surveyed one month and eight months after conference attendance to determine longer-term impacts. The study findings demonstrate that women computing majors felt an improved sense of belonging and academic self-concept after attending the conference. Students felt more optimistic about their ability to connect with peers, faculty, and industry partners and their ability to persist through the computing degree. Implications for institutions and research are also discussed.

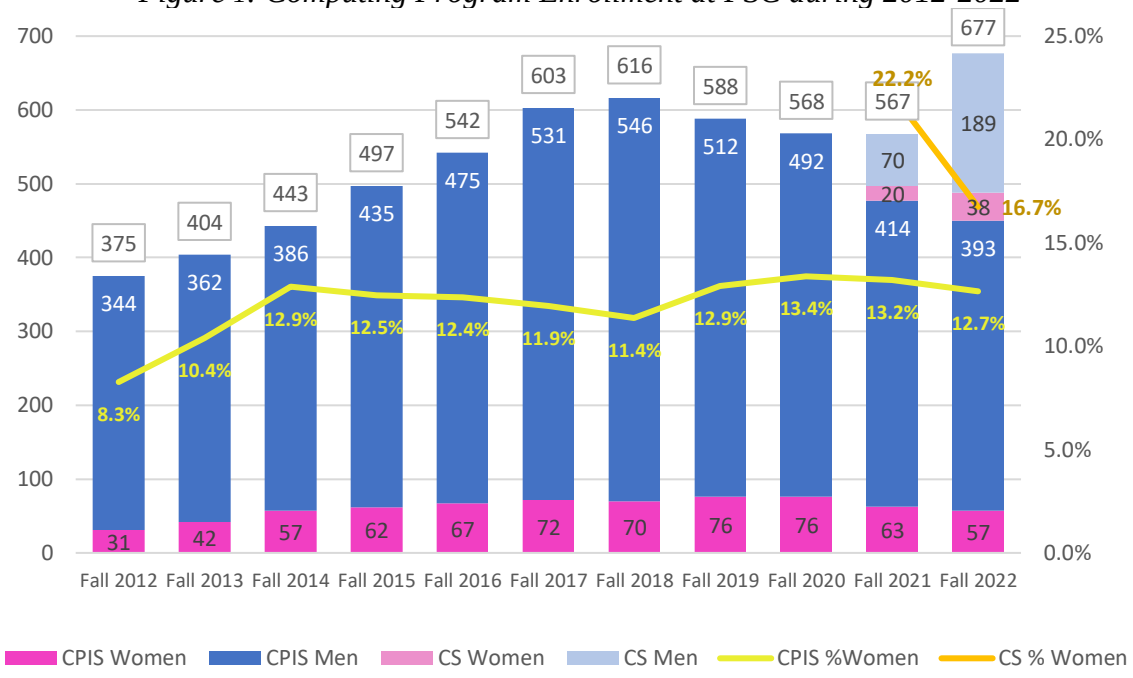
1. Introduction and Background

Farmingdale State College (FSC) is a four-year commuter college with approximately 10,000 students enrolled, where about 10% reside on campus. As part of the large New York State college system of 64 institutions, FSC is recognized as having graduates with the lowest student-debt at the time of graduation while 82% of students work full or part-time while pursuing their studies. FSC offers small class sizes (average of 23) and has a diverse student population where 41% are women and 51% come from underrepresented racial and/or ethnic background as of fall 2021. As a contextual factor of commuter institutions, many of the students have not had the opportunity to travel on their own and the idea of attending a conference independently is quite novel. The study provided a new opportunity for students, compared to residential college students where students are accustomed to being away from home.

The Computer Systems Department at FSC offers two computing programs, namely Computer Programming and Information Systems (CPIS), that has existed for over twenty years, and Computer Science (CS), launched in fall 2021. The enrollment has almost doubled, reaching 677

at its peak in fall 2022 over the last decade, but the percentage of women hovers between 8-15% (Figure 1). There was a slight spike in the percentage of women enrollment in the introductory semester of the CS program; however, that has since smoothed. In spring 2020, two tenured women faculty members conducted an analysis of the FSC College activities and initiatives, albeit not sustainable due to assorted reasons, taken by the Computer Systems department from 2011 through 2020 to address the gender disparity [1]. Findings from this analysis were used in implementing more recent initiatives from spring 2020 which include fostering a Women in Computing Student Club [2], executing a summer orientation program exclusively for women enrolled in the computing majors in August 2021 and August 2022 [3], and attending women-centric computing conferences.

Figure 1: Computing Program Enrollment at FSC during 2012-2022



This study explores how attendance to a conference with the focus of supporting women in computing impacts women students' sense of belonging and connection to the school, and their academic self-concept [4-6] in short and longer term. In this paper, woman and women are used as both nouns and adjectives to refer to the gender of woman-identified students. Man and men are being used as both nouns and adjectives to refer to the gender of man-identified students. Institutions like FSC college would be well-served to develop a better understanding of the ways in which academic co-curricular experiences, such as academic conferences, can shape women students' sense of belonging. The goal of this research is to measure the impact of attending a regional ACM-W supported Celebration of Women in Computing [7] conference, as such, three research questions guide this study:

(1) Is there an impact on student sense of belonging and connection upon return after attending a conference?

(2) Do students have a positive academic self-concept upon return?

(3) Do any impacts persist one month and or eight months after conference attendance?

In addition to pre- and post-conference surveys, a look at end of semester survey responses one month after conference attendance (end of Spring 2022 semester survey) and eight months after conference attendance (end of Fall 2022 semester survey) are evaluated to measure longer term impact of the conference attendance.

The remainder of the paper is organized as follows. Section 2 includes a review of related work; section 3 includes details about the spring 2022 conference attendance logistics, decision-making, and planning process. Section 4 presents the research methodology; section 5 presents the pre- and post-conference survey results and analysis, and end of semester survey results one month and eight months after the field trip. Section 6 discusses the lessons learned, summarizes findings, and identifies future work.

2. Related Work

Sense of Belonging and Connection

The number of women enrolled in undergraduate STEM programs has seen an increase over the last ten years [12]. However, that growth has not corrected the disproportionate number of women who earn bachelor's degrees in the social and behavior sciences and the biological sciences. As of 2020, women have earned 26% of the bachelor's degrees in mathematical and computer sciences and 24% of the bachelor's degrees in engineering [12]. These data represent a 34-percentage point increase in the total number of STEM bachelor's degrees award to women from 2011 to 2020. Despite a growth in earned bachelor's degree for women in the STEM fields more broadly, there has been a minimal increase of 3 percentage points in the proportion of the STEM workforce that were women from 2011 to 2020 [12].

Sense of belonging has become a recent focus in studies of equity in higher education, particularly among literature related to underrepresented student populations in higher education and the STEM field, more specifically. Educational researchers have defined a sense of belonging as a student's connection to the institutions in which they are enrolled and within the communities of that institution [16]. These communities can span both the academic and social sectors of a college or university. Researchers have put forward a student involvement theory that engagement in the institution's academic and social sectors is critical in student success [13]. Developing relationships with faculty and peers outside of the classroom through co-curricular activities has proven to increase student retention [15], student persistence in a major [17, 18] and self-reported benefits for students [14]. While enrolled in undergraduate degrees, students experience many benefits from an increased sense of belonging.

Further research is needed to determine how institutions can increase connections between their students and their students' prospective workforce. While sense of belonging at an institution increases ties to the student's major and the institution overall, does this translate to future career fields? As such, this study builds off previous sense of belonging studies, particularly for underrepresented students in the STEM field. More specifically, it aims to explore the how interventions can cultivate a sense of belonging for women with the computing career field that their academic program is preparing them to enter upon graduation.

Academic Self- Concept

Academic self-concept provides a mechanism for how students view themselves, their capabilities, and their response to academic challenges [4-6]. When applying academic self-concept to underrepresented student groups in the STEM fields, it is useful in predicting non-

cognitive components of student success [4]. Specifically, in the STEM fields, women are more likely to have a higher level of academic self-concept in biology and medicine, where men are more likely to develop greater academic self-concept in engineering, math, and physics [8]. Given the significant disparities in enrollment in computer science by gender, future research needs to identify the impact on interventions designed to increase academic self-concept for women.

Previous research has found that attending conferences provided students with opportunities for career and research exploration, increased students' networking skills, increase enthusiasm for the subject matter, and increased a sense of belonging within the larger discipline community [9]. Attending a conference also provides students with opportunities to present and gain technical skills and positively influence their professional confidence and identity [10]. It is found that African American students were more likely to go to the conference to help their self-esteem or find potential advisors/mentors [10]. Additionally, a previous study found that attending a conference positively impacted students' confidence in academic spaces, their communication skills, and future engagement in extracurricular activities [11].

However, further research is needed to determine whether meeting participation facilitates increased engagement in the computing fields for women. More specifically, this paper investigates the role of attending conferences on women's academic self-concept in the computing field and how that might propel women into the STEM workforce.

3. Conference Attendance to NYCWiC'22

This section provides details about the spring 2022 conference attendance planning, logistics, and decision-making process to provide the readers with a better background and context.

The New York Celebration of Women in Computing (NYCWiC) conference (https://nycwic.org) is supported by the parent organization ACM-W and is annually organized to support the academic, social, and professional growth of technical women in New York area. Compared to the international Grace Hopper Celebration (GHC, https://ghc.anitab.org), the ACM-W regional celebrations connect technical women in a particular geographic area. NYCWiC is one of the most successful ACM-W celebrations where student registration covers food, registration fee, and lodging as a nominal fee and is organized as a two-day event requiring an overnight stay.

In spring 2020, 28 students and three faculty of FSC college were funded and registered to attend NYCWiC'20. Due to COVID-19 pandemic, the conference was cancelled. In spring 2021, NYCWiC'21 was held virtually, in total 8 students and two faculty attended, and the faculty co-advisors moderated a Birds of Feather session while the *SWiC (Supporting Women in Computing club)* student officers presented a poster. In spring 2022, campus funding was secured to take more students to NYCWiC'22 in Lake George, NY. A summary of planning and coordination details for attending this spring 2022 conference is provided below.

Attendees

The original proposal was to fund up to 30 women students and two faculty members to attend the NYCWiC'22. The invitation was sent to all women enrolled in the CPIS and CS programs in spring 2022 semester. However, several men students also requested to attend. The decision to include interested men attendees was made for a variety of reasons including some are active in the SWIC events and there is a healthy camaraderie with co-ed student clubs. The initial sign-up list exceeded the proposed number and reached 47 with 34 (72%) women and 13 (28%) men.

However, at the end, 34 students with 24 (~70%) women and 10 (~30%) men along with two faculty attended the trip. The decrease in student attendance from 47 was due to several reasons (conflicts, illness, transport to the campus, and last-minute emergencies).

Planning and Oversight

Students were required to complete several documents to attend the conference through Qualtrics software and Google Forms. However, many forms were incomplete upon submission. This required faculty advisors to follow up with individual students to complete the paperwork. Students attended a mandatory pre-travel meeting where logistics, dress code and expectations of conduct were reviewed.

Managing Student and Parent Expectations

As most FSC students are commuters, an overnight trip was a new experience for many. As a result, parents wanted to chaperone which led to discussions with parents about safety and supervision. In the end, all students attended the conference independently. Due to COVID-19 protocols, the conference attendee capacity was limited, and had single room occupancy for most attendees. A few students were required to double up in suites as was requested by the conference administrators. The conference fell during fasting month of Ramadan and accommodations were made by the conference to cater to those observing enabling all interested students to participate.

Student and Faculty Involvement at Conference

Students and advisors had additional roles while attending the conference. Two women students had research abstracts accepted as research presentations and as posters. The SWiC (Supporting Women in Computing Club) officers presented a poster about effectively running the club returning to campus post-pandemic. The faculty advisors acted as panelists, session moderators, and table topic leaders upon request of the conference leaders.

4. Methodology

This research study explores how attending an ACM-W Regional Celebration of Women in Computing conference impacted undergraduate women students in computing majors at a public, commuter institution in the northeast. This study was approved by the college's institutional review board (IRB).

Participants

All conference attendees from FSC College were invited to participate in the study. Study participants were (a) over the age of 18, (b) self-identified as woman or man, and (c) enrolled in a computing degree program. Students were informed that lack of participation in the pre- and post-conference surveys would not impact on their ability to attend the conference, their status in their computing degree programs, and that their responses were confidential.

Most student attendees were majoring in CPIS, with CS providing the second largest group (Table 1). Of the students who attended and took the post-conference survey, 10% (3/29) were first year students, 24% (7/29) were sophomore year, 31% (8/29) were junior year, 27% (8/29) were senior year, and 6% (2/29) were alumni who graduated in December 2021. Of the two alumni students who attended, one student was a former officer of SWiC and was presenting a poster. About half of the students (15/29) transferred to FSC which is consistent with college demographics.

Table 1: Breakdown of Attendees by Major of Study

	Pre-Survey		**Post-Survey**	
CPIS (Computer Programming Information Systems)	69.70%	23	79.31%	23
CS (Computer Science)	21.21%	7	13.79%	4
Computer Security	3.03%	1	3.45%	1
Other (was filled in Computer Engineering)	6.06%	2	3.45%	1
Total	100%	33	100%	29

Table 2 is a breakdown of attendees by gender. Note that agender, cisgender, intersex, non-binary, transgender and prefer to self-describe were all options provided, but not selected and therefore not reported in the table. Table 3 provides a breakdown by origin demonstrating even more diversity and participation from underrepresented racial and/or ethnic background (73%, 24/33) compared to the college demographics (53% as of fall 2021). Most attendees (80% of pre-survey and 86% of post-survey) were members of SWiC while a smaller, but significant number of attendees (30% of pre-survey and 28% of post-survey) were members of the ACM Computer Tech Club. The large presence of students from student clubs demonstrates the impact of student clubs in bringing awareness to the women-centric events. In addition, a significant number of attendees (30% pre-survey and 31% of post-survey) had attended the Summer 2021 (Re)Orientation for Women Computing Students that was performed at the FSC college. The two faculty co-advisors had organized the event to create connections among the women students in the CPIS and CS majors. The majority (~81%, 27/33) had never attended a conference before while 18% (6/33) had attended the only virtual NYCWiC'21 conference. Only one student reported having attended a different conference. This demonstrates the inexperience of the FSC women computing students with conference attendance.

Table 2: Breakdown of Attendees by Gender

	Pre-Survey		Post-Survey	
Woman	72.73%	24	72.41%	21
Man	27.27%	9	27.59%	8

Table 3: Breakdown of Attendees by Race/Ethnicity

	Pre-Survey		Post-Survey	
Hispanic, Latino, or of Spanish origin	27.27%	9	27.59%	8
Asian	39.39%	13	41.38%	12
Black or African American	6.06%	2	6.90%	2
White	27.27%	9	24.14%	7
Total	100%	33	100%	29

Data Collection

Prior to the conference trip, students completed a pre-conference survey. A post-conference survey was administered upon return, and then one month after conference attendance (end of spring'22 survey), and eight months after conference attendance (end of fall'22 survey). The pre-survey focused on student expectations prior to attending the conference and the post-survey

focused on impact and how the conference met student expectations. The pre- and post-survey responses are reported for all genders; however, on a few questions that measure what attendees took away from attending the conference and how they believe it will impact upon return to campus in the short- and longer-term responses are presented by gender for comparison. Pre-conference surveys (n=33) yielded slightly more responses than the post-conference surveys (n=29).

5. Survey Results and Analysis

This section discusses the survey results and analysis with respect to the general responses as well as the research questions.

General Responses

General Responses includes three categories: motivation and expectation of attendees, what students gleaned from attending conference, and beyond NYCWiC'22 as presented in sub sections below.

Motivation and Expectation of Attendees

Expectations and motivation for attending the conference and the degree to which these expectations were met are consistent across the pre- and post- conference surveys. There was a slight increase in those who wanted to be away with friends and classmates from pre- to post-survey. This is interpreted positively as students bonded through the experience. The overwhelming majority of the students wanted to hear from industry leaders and to attend the job fair pre-conference. There was a subtle increase in these categories post-survey which was interpreted positively that students were pleased with what they experienced attending the job fair.

Attendees were surveyed about their interest in the areas of content offered at the conference. The pre-survey was also a tool to inform the students what to expect and the variety of sessions offered at the conference. Respondents consistently rated the same conference options favorably on the pre-survey (rated very interesting and interesting) and the post-survey (rated most interesting and interesting). However, several items that were rated as "very interesting" on the pre-survey were rated lower (rated "interesting") on the post-survey. Examples of what was rated lower on the post survey were Keynote Speakers, Panel Sessions, and Career Fair. Overall, the attendees found most interesting and interesting combined in the post survey were extremely positive.

At the end of the pre-survey, there was a free form response question *"What are you hoping to gain from attending this field trip?"* The responses have been grouped whereby most students (~94%, 31/33) responded demonstrating attendees' enthusiasm to attend the conference. More than half (58%, 18/31) of the responses mentioned networking or making connections. Such answers included statements like: *"learning to network,"* and *"I'm hoping to make connections and meet other people in the computing field."* A suitable number of responses (29%, 9/31) included gaining more knowledge. Such answers included statements like: *"I hope to gain a better idea of possibilities after undergrad," "I am hoping to gain more knowledge"* and *"I hope to gain a lot of insight of other women's career paths and how they reached their goals."*

What Students Gleaned from Attending Conference

Table 4 below shows responses from attendees on what they gained from attending the conference in post-conference survey. Students rated gaining soft skills in sessions focused on

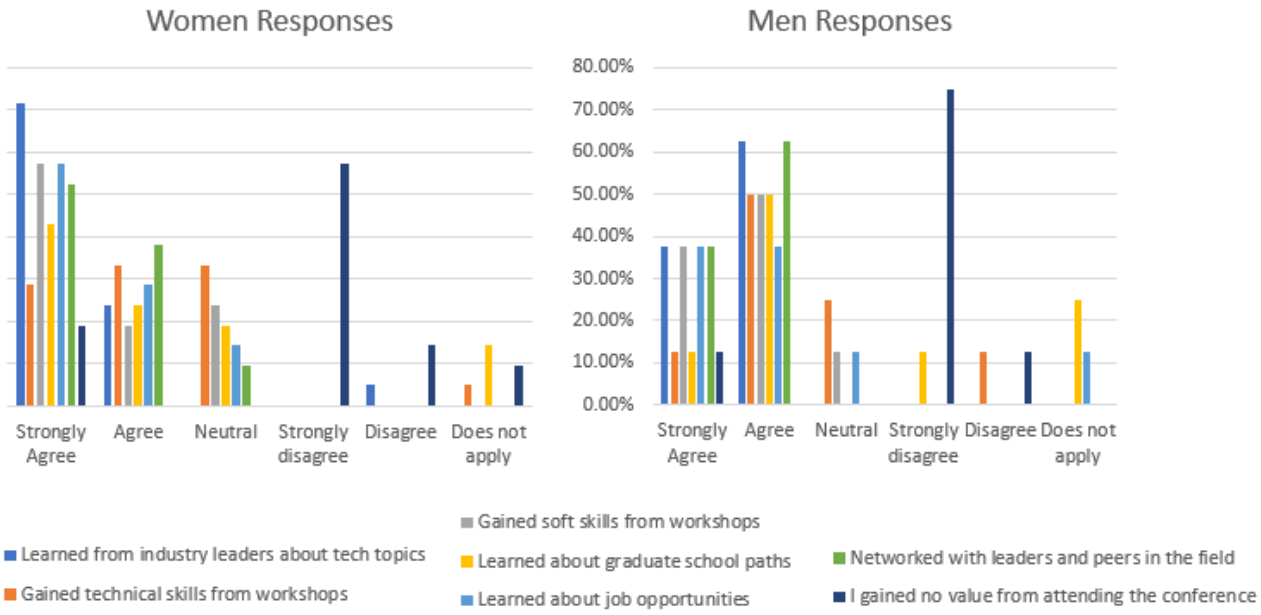
areas outside of technology and on burnout/mental health in the industry/academia more favorably. While 62% (18/29) indicated that they strongly agreed they learned from industry leaders, only 24% (7/29) strongly agreed that they gained technical skills. Workshops at the conference were not technical in nature, so this result is consistent. Graduate school paths had a medium response as students of this commuter, public college were less interested compared to the industry path going in. Networking with leaders and peers received extremely high ranking (~93%). Few students felt attending the conference provided no value (17.2%, 5/29 strongly agreed).

Table 4: Compilation of results of what all attendees felt they gained from attending conference.

Survey Response to question: Now that you attended the conference, what did you learn or gain from attending? N = 29	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree	Does Not Apply
Learned from industry leaders about tech topics	18	10	0	0	1	0
Gained technical skills from workshops	7	11	9	0	1	1
Gained soft skills from workshops	15	8	6	0	0	0
Learned about graduate school paths	10	9	4	1	0	5
Learned about job opportunities	15	9	4	0	0	1
Networked with leaders and peers in the field	14	13	2	0	0	0
I gained no value from attending the conference	5	0	0	18	4	2

However, it is noteworthy to look at the subtle disparity in the responses to the above questions (in Table 4) by gender as depicted in Figure 2 below. Women attendees had a higher percentage across the board of strongly agree than men responses although women were a bit higher on neutral. When adding strongly agree and agree together, responses are closer for men and women, but the emphatic strongly agree is noteworthy by the women respondents. Both audiences strongly disagreed that there was no value in attending the conference.

Figure 2: Women vs. Men Responses: what felt they gained from attending conference?



Beyond NYCWiC'22

Data in Table 5 indicates that most attendees were interested in returning to NYCWiC next year (96% strongly agreed or agreed) which is an indication of attendee satisfaction with this conference's attendance and the positive experience post conference. Some may be graduating next year, which explains the high number of N/A especially in 'other' category as respondents may not know what other options may have been. Most attendees were also interested in attending the international GHC soon (75% strongly agreed or agreed), no attendees had participated in GHC in person or virtually.

Table 5: Responses about returning the following year or attending other conferences.

POST-Survey gauging interest if students would like to return or go to other conferences, N =29	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree	N/A
NYCWiC 2023 next year	25	3	0	0	0	1
Grace Hopper Conference (GHC) Fall 2023	17	7	3	0	0	2
Grace Hopper Conference (GHC) Fall 2024	17	7	2	0	0	3
A local/ regional Women Centric Event in NY area	18	10	1	0	0	0
Other	5	1	3	0	0	20

Research Question #1: Connection and Sense of Belonging for Women Computing Majors

Table 6 presents results demonstrating the positive impact of bonding and connection among conference attendees. The majority of the FSC students are commuters and are employed off campus leaving limited time to bond with classmates outside of class. Almost all students (96%)

felt that they bonded with their classmates because of the conference. Most strongly agreed or agreed (~90%, 26/29) that they feel they will have better peer support in their classes upon returning. Almost all students felt they expanded their network.

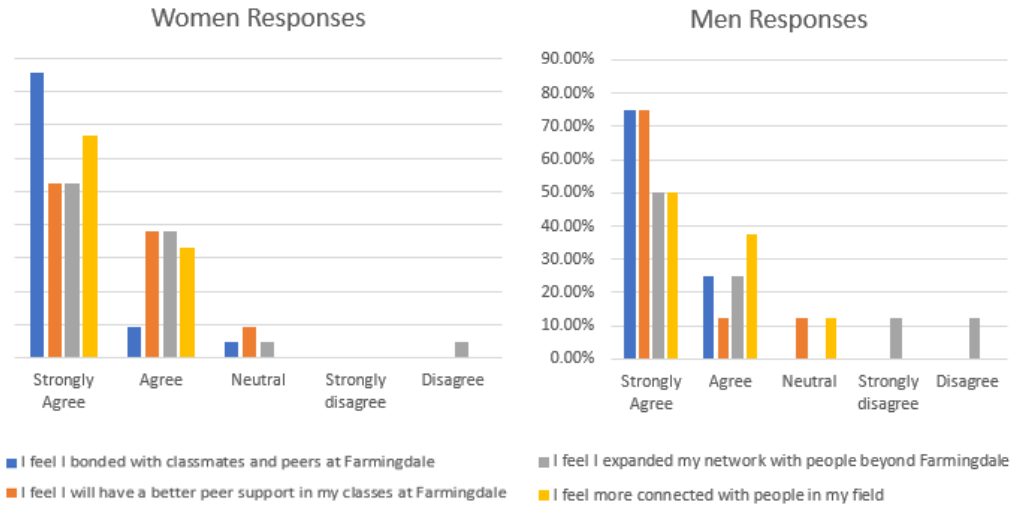
When prompted if attendees felt they would get more involved with the SWiC Club or if they would be interested in taking a leadership role in SWiC Club, most of the students (~90%, 26/29) strongly agreed or agreed to become more involved in SWiC, and to take a leadership role (65%, 19/29 strongly agreed or agreed). This suggests that the trip positively influenced students to become more involved in extracurricular computing opportunities. Maintaining student involvement in student clubs has been a challenge as 82% of FSC students are employed while pursuing their studies. It is expected attending the field trip, encourages students to expand student involvement and develop their sense of belonging.

Table 6: Student perspective after attending the conference.

POST-Survey Response to: Now that you attended the conference, how do you feel? N = 29	Strongly Agree	Agree	Neutral	Strongly disagree	Disagree
I feel I bonded with classmates and peers at FSC	24	4	1	0	0
I feel I will have better peer support in my classes at FSC	17	9	3	0	0
I feel I expanded my network with people beyond FSC	15	10	1	1	2
I feel more connected with people in my field	18	10	1	0	0
I feel I will get more involved with the SWiC Club on campus	19	7	3	0	0
I feel I would like to take a leadership role with SWiC Club	12	7	10	0	0

Responses above are reported for all attendees including all genders, however since the focus of this study is to measure the impact attending a computing conference on women student attendees, Figure 3 below shows the breakdown of women and men responses in the above data (in Table 6). Figure 3 shows that despite women feeling very strongly (over 80%) about feeling bonded with classmates and peers, women strongly agree only 52% that they will have better peer support in classes upon return. However, the male students had higher percentage (75%) of strongly agreeing about expecting better peer support in classes upon return. Overall, 92% of women (strongly agree and agree) left feeling they will have better peer support whereby the 87.5% of males (strongly agree and agree).

Figure 3: Women vs. Men Responses: bonding with classmates and impact on their networking



The post-survey prompted students to enter free form response to the questions: *"Write a summary of your experience attending the conference, what you liked and did not like. What was the highlight of the conference for you? Were there any bad experiences?"* Some of the free form responses (35%, 10/29) included networking or making connections. Such answers included statements like *"I was able to meet new people and make new connections"*, *"I really liked the opportunity to network"*, and *"I was able to expand my connections."* Another ~28% (8/29) responses highlighted gaining more knowledge and learning about different career paths. Such answers included statements like *"I was offered all different types of information"*, *"filled with learning opportunity"*, *"learned a lot from the workshops"*, and *"gained more knowledge"*. Finally, ~39% (11/29) of the responses included general positive statements regarding the conference (i.e., *"It was a nice experience"*, *"I had a lot of fun!"*).

Research Question #2: Confidence and Academic Self-Concept of Women Computing Majors

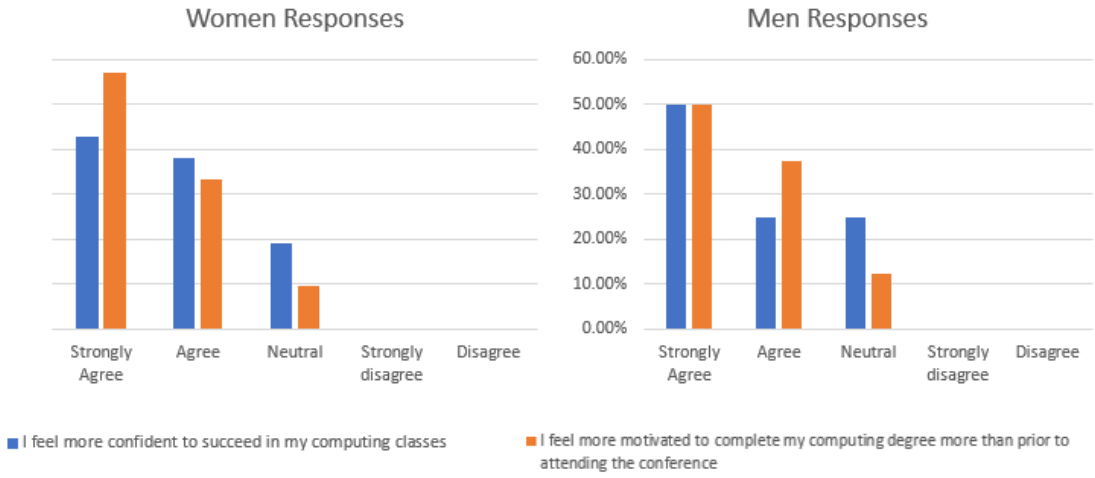
Table 7 shows the results of the positive impact of the conference attendance on the academic self-concept of the students. The majority now feels more confident about succeeding in their computing classes (79%, 23/29). This data suggests that attending the conference and exposure to broader perspective energized students about the industry and career options. Data in Table7 closely supports the goal of the longer-term student outlook where almost (~90%, 26/29) strongly agree or agree that they feel more motivated to complete their computing degree.

Table 7: Student feedback after conference re: computing classes and finishing their degrees.

POST-Survey Response to: As a result of attending the conference, how do you feel? N = 29	Strongly Agree	Agree	Neutral	Strongly disagree	Disagree
Feel more confident to succeed in my computing classes	13	10	6	0	0
Feel more motivated to complete my computing degree	16	10	3	0	0

Looking at the above data (in Table 7) by gender in Figure 4 below suggests that 80% of women (strongly agree and agree) feel more confident to succeed in computing classes and 90% feel more motivated (strongly agree and agree) to complete their degree than prior to attending the conference. Whereby 75% of males (strongly agree and agree) felt more confident to succeed in computing classes and 87.5% (strongly agree and agree) felt more motivated to complete their degree than prior to attending the conference. This data shows that the comparative impact was slightly higher (and not significant) for women students than men students.

Figure 4: Women vs. Male Response post conference re: computing classes& finishing their degrees.



Research Question #3: Longer Term Impact on Sense of Belonging and Academic Self-Concept

CS and CPIS women students are asked via email to complete surveys at the end of each semester to measure the impact of some initiatives underway to improve the gender disparity in the computing programs. Table 8 below summarizes the survey response rate that pertains to attending the field trip.

Table 8: End of Semester Surveys Respondent Counts

Term	Total Respondents	Respondents that attended April 2022 ACM-W Regional Conference
Spring 2022	23	4
Fall 2022	38	6

The end of spring 2022 semester survey (in May, one month after the conference trip) respondents all identified as women and were 1 Hispanic, 2 Asian and 1 White. All four were not members of SWiC and responded as follows to prompts about the impact of attending the Regional ACM-W Conference. Table 9 below summarizes the response to relevant direct question of how the remainder of their semester upon returning from the trip in April. 75% say the rest of spring semester was positively impacted with 25% strongly agree and 50% Agree, where 25% remained neutral or can be interpreted that attending the conference had no impact on the remainder of their semester.

Table 9: Spring '22 Student Responses about what they Took Away from the Attending NYCWiC '22?

N = 4	Strongly Agree		Agree		Neutral		Disagree	
The rest of my Spring 2022 semester was positively impacted	25.0%	1	50.0%	2	25.0%	1	0.0%	0

Table 10 has the responses from the end of spring'22 (one month after the trip) and the end of fall'22 surveys (eight months after the trip). These question prompts are focused on the connections made at the conference and measuring how students were still feeling about these connections one month after and eight months after attending the NYCWiC'22. One month after 100% (25% strongly agree and 75%) agreed that they feel bonded with classmates and peers. However, eight months later only 83.3% feel bonded with classmates, so maybe some of the connections and bonds made had dissipated. The peer support prompt is 75% (25% strongly agree and 50% agree) one month after conference; however, eight months later the peer support is rated 83.4% (higher) than a month later (66.7% strongly agree and 16.7% agree). These two prompts are demonstrating that peer support and positive sense of belonging are still strong eight months after attending field trip.

Table 10: May'22 and December'22 End of Semester Survey about connection, belonging and support.

	Spring'22 End of Semester Survey Results (N = 4)										Fall'22 End of Semester Survey Results (N = 6)									
	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Strongly Agree		Agree		Neutral		Strongly Disagree		Disagree	
	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
I feel I bonded with classmates and peers at Farmingdale	25	1	75	3	0	0	0	0	0	0	83.3	5	0	0	0	0	0	0	16.7	1
I feel I have a better peer support in my classes at Farmingdale	25	1	50	2	25	1	0	0	0	0	66.7	4	16.7	1	0	0	0	0	16.7	1
I feel I expanded my network with people beyond Farmingdale	50	2	0	0	25	1	25	1	0	0	66.7	4	0	0	16.7	1	16.7	1	0.0	0
I feel more connected with people in my field	50	2	25	1	25	1	0	0	0	0	33.3	2	16.7	1	33.3	2	0	0	0.0	0

Table 11 compares survey results from end of Spring'22 and Fall'22, examining if the students feel more confident to succeed in their computing classes and more motivated to complete their computing degree after attending the conference. This prompt attempts to measure the Academic Self Concept and Confidence of women students one month and eight months after attending the conference. The results are promising in that 75 % of women (25% strongly agree and 25% agree) feel more confident to succeed in their computing classes one month out, and even more confident eight months out with students responding 100% (83.3% strongly agree and 16.7%

agree). Similarly, the responses at the end of Fall'22 are positive about feeling more motivated to complete their computing degrees where it was 75 % at end of spring'22 (50% strongly agree and 25% agree) and 83.3% strongly agree eight months later.

Table 11: Spring '22 and Fall '22 End of Semester Survey measuring Academic Self Concept

	Spring'22 End of Semester Survey Results (N = 4)										Fall'22 End of Semester Survey Results (N = 6)									
	Strongly Agree		Agree		Neutral		Strongly Disagree		Disagree		Strongly Agree		Agree		Neutral		Strongly Disagree		Disagree	
	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
I feel more confident to succeed in my computing classes	25	1	25	1	50	2	0	0	0	0	83.3	5	16.7	1	0.0	0	0	0	0	0
I feel more motivated to complete my computing degree more than prior to attending the conference	50	2	25	1	25	1	0	0	0	0	83.3	5	0.0	0	16.7	1	0	0	0	0
I feel empowered from the knowledge gained from the industry leaders, women, researchers											50.0	3	0.0	0	16.7	1	0	0	16.7	1

6. Conclusions & Future Work

Programmatic Implications

There were many logistical lessons learned for the trip faculty leaders that are specific to FSC and are internally noted for future trips. One note about the focus on inclusivity such that the decision was made to allow male students to attend the spring 2022 trip. In hindsight, the dynamic changed among the women attendees when male students were present. This was also an expressed concern of the SWiC student leadership board. For the upcoming spring 2023 conference trip, only women-identifying students (cis or non-binary) will be permitted to attend.

Research Implications

This paper discussed the benefits, and short and perceived long-term impact on computing students attending a regional Women in Computing conference. Students had positive feedback and reaction to attending the conference. Significant factors included the opportunity to bond with classmates and peers, network with others from outside FSC, and hear from industry leaders. Student attendees felt the connections made with fellow attendees would be maintained upon return, and post conference, felt they were more likely to succeed in their classes, become more involved in club activities on campus, and reported renewed enthusiasm and motivation for completing their degree. As a result, their sense of belonging and connection to the institution and the computing field increased.

Women student survey data from one month and eight months after attending the conference strongly supports that there is a positive impact on student attitude and experience in coursework upon return after attending a conference (one month and even more so eight months later). The data also similarly answered the research question that students have a positive academic self-concept upon returning from conference, one month and eight months later. The conference assisted students in their confidence to complete their degree program and utilized the knowledge gained from the conference in their future coursework. It seemed that the longer the time elapsed from the conference, the more positive students felt.

Future Work

The plan in the future is to continue this work on attending more trips, monitoring their impact, and gauging the women student experience and academic self-concept at FSC in the computing programs offered by the Computer Systems department through end of semester surveys. The trip discussed in this paper included men attendees, the upcoming spring 2023 trip will not include FSC men attendees and through observation and survey, the two trips will be compared to evaluate the influence of men attendees. The survey responses will be evaluated, analyzed, and reported in conjunction with the enrollment, retention, and women student academic performance.

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