



The 2018 Computing Research Association
Grad Cohort Workshop for Underrepresented
Minorities + Persons with Disabilities (URMD)
Pre/Post Participant Evaluation Report

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Suggested Citation:

Wright, H. M. (2018). The 2018 CRA Grad Cohort Workshop for Underrepresented Minorities + Persons with Disabilities (URMD): Pre/Post Participant Evaluation Report. Washington, DC: Computing Research Association.

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About CERP

The Computing Research Association's (CRA) Center for Evaluating the Research Pipeline (CERP) evaluates the effectiveness of intervention programs designed to increase retention of individuals from underrepresented groups in computing, namely men from underrepresented racial/ethnic groups, and women of all racial/ethnic backgrounds. More generally, CERP strives to inform the computing community about patterns of entry, subjective experiences, persistence, and success among individuals involved in academic programs and careers related to computing.

CERP was created by the Committee on the Status of Women in Computing Research (CRA-W)/Coalition to Diversify Computing (CDC) Alliance through a National Science Foundation grant to the Computing Research Association (CNS-1246649). The current research was supported by NSF grant CNS-1246649. Any opinions, findings, conclusions, and recommendations are the authors' and do not necessarily reflect the views of the National Science Foundation.

For more information about CERP, visit <http://cra.org/cerp/>.



Executive Summary

The Computing Research Association (CRA) Grad Cohort Workshop for Underrepresented Minorities + Persons with Disabilities (URMD) is a two-day workshop for underrepresented students in computing-related graduate degree programs. Center for Evaluating the Research Pipeline evaluated the workshop using a pretest/posttest framework, wherein participants completed a survey prior to, and immediately after, the workshop. Results suggest that overall (a) the URMD workshop had a positive immediate impact on participants' outcomes and (b) participants were satisfied with their experience in attendance.

Key Findings

After attending URMD, compared to before, all participants reported:

- Stronger sense of belonging in computing
- Stronger computing identity
- Greater self-efficacy in computing
- Greater professional skills
- More interest in pursuing the following career paths:
 - Middle/high school teacher
- Less interest in pursuing the following career paths:
 - Tenured faculty in a computing department at a teaching college
 - Entrepreneur (computing related)
 - Non-computing career

Participants' suggestions for improving Grad Cohort include the following:

- Incorporate more perspectives for unique groups
- Encourage speakers to leave time for Q&A during sessions
- Use smaller, but more, tables for lunch.
- Build in additional breaks, as well as longer breaks

Introduction

Since 2004, the Computing Research Association (CRA)'s Committee on the Status of Women in Computing (CRA-W) has been organizing the CRA-W Grad Cohort for Women workshop (CRA-W Grad Cohort), a two day mentoring workshop for women in computing-related graduate degree programs. Since its inception, CRA-W Grad Cohort has been seen as an important catalyst for women's persistence in computing-related disciplines. CRA's Center for Evaluating the Research Pipeline (CERP) began evaluating the CRA-W Grad Cohort workshop in 2014, and CERP results indicate that the workshop has a strong positive immediate impact on participants (Cundiff, Stout, & Wright, 2014; Stout & Wright, 2015; Wright & Stout, 2016; Wright, 2017). CERP has also found long-term benefits of CRA-W Grad Cohort. For example, CERP found that participants from the 2011-2012 workshops were more likely to have collaborators from outside their home institutions on first authored publications compared to other mentoring workshop participants and non-participants (Stout & Cundiff, 2014). Finally, in a recently published journal article, CERP found that past CRA-W Grad Cohort participants had a stronger interest in giving back to the community than non-participant women and men (Stout, Tamer, Wright, Clarke, Dwarkadas, & Howard, 2017).

While the CRA-W Grad Cohort workshop has been successful at making a positive impact on participants, the workshop only reaches women graduate students in computer science. The computing field's lack of diversity extends beyond women: of doctoral computer science degrees awarded in 2014, only 10.3% of those came from underrepresented racial minorities¹ and 5.9% from persons with disabilities (National Science Foundation, National Center for Science and Engineering Statistics, 2017). Just like women, these underrepresented groups are more likely to feel like they do not belong in their domain (Szymanski, Lutz, Shahan, & Gala, 2013; Walton & Cohen, 2007) than their well-represented peers.

To fill this gap in reaching other underrepresented students in computing, CRA created the Grad Cohort Workshop for Underrepresented Minorities + Persons with Disabilities (URMD Grad Cohort). Modeled after the CRA-W Grad Cohort workshop, URMD Grad Cohort is a two-day workshop for underrepresented students in computing graduate degree programs with the goal of increasing students' sense of belonging and persistence in the field. URMD Grad Cohort gives participants the opportunity to connect with a supportive community and create professional networks of peers and senior researchers in the field. Through seminars and discussions, URMD Grad Cohort engages participants in a number of topics related to career pathways and tips for success in their graduate degree program. URMD Grad Cohort also provides one-on-one mentoring and professional development to promote students' successful progression into computing research careers.

CRA enlisted CERP to evaluate the efficacy of the inaugural URMD Grad Cohort. Using a pretest/posttest methodology, CERP surveyed participants before the workshop and immediately following it to assess any immediate impacts of URMD Grad Cohort. This report discusses CERP's evaluation efforts and results of their analysis on the workshop's immediate impact on participants' outcomes (e.g., sense of belonging) and utility. At the end, CERP discusses recommendations for future workshops based on the overall findings.

¹ Underrepresented racial minorities included in this calculation are the following: American Indian/Alaska Native, Black/African American, Hispanic/Latina(o), and Native Hawaiian/Pacific Islander.

Evaluation Method

Procedure

CERP evaluated the URMD Grad Cohort workshop using a pretest/posttest framework², wherein participants were recruited at two time points (two weeks prior to and immediately following the workshop) to complete an online survey gauging their experiences in their computing degree programs, self-assessments of skills, highest degree intentions, and career interests. The survey administered after the workshop also contained questions capturing participants' feedback and evaluation of the workshop.

Participants

In its inaugural year, CRA received 200 applications for the URMD workshop and 113 were accepted (57% acceptance rate). Of those accepted, 89 participants attended the workshop and 80 completed the survey at both time points (90% pre/post response rate). Among the participants, 80% were enrolled in PhD programs and 20% were in terminal master's or joint bachelor's/master's programs. Demographic characteristics of participants who completed either of CERP's surveys ($n = 88$) are displayed below in Table 1.

Table 1. URMD Grad Cohort Demographic Characteristics by Gender.

| | Men (N = 33) | Women (N = 47) | Other or Not specified (N = 8) | All participants (N = 88) |
|-------------------------------------|-----------------|-------------------|--------------------------------------|------------------------------|
| All Participants | 38% | 53% | 9% | 100% |
| Racial/Ethnic Identity | | | | |
| African American or Black | 36% | 51% | 13% | 42% |
| Asian or Asian American | 9% | 4% | 13% | 7% |
| Hispanic or Latina/o | 30% | 26% | - | 25% |
| White or Caucasian | 6% | 11% | - | 9% |
| Multi-racial or Other/Not specified | 19% | 8% | 74% | 17% |
| Person with Disability | 33% | 19% | 13% | 24% |
| U.S. Citizen | 53% | 62% | 13% | 53% |

Notes. Values represent the percentage of men/women/other participants within each demographic characteristic. For example, 33% of men, 19% of women, and 33% of other participants identified as a person with a disability. Percentages may not equal 100% due to rounding error. N = number of individuals within each group.

Measures

For the evaluation of URMD Grad Cohort, CERP examined changes over time for all participants using the following self-reported quantitative outcome measures: sense of belonging in computing, computing identity, self-efficacy

² It is important to note that positive changes between Time 1 and Time 2 responses suggest, but do not prove, positive impact of URMD Grad Cohort. Due to limitations inherent in pretest-posttest self-reported data, changes between Time 1 and Time 2 could be due to response bias, demand characteristics, or may be fleeting and not be sustained over time.

in computing, professional development skills, and career interests. For master's students, CERP also examined changes in their (a) interest in pursuing a PhD and (b) highest degree intentions.

Reliability was determined for multi-item outcome measures (e.g., sense of belonging) using Cronbach's alpha. Alpha levels $\geq .70$ are considered acceptable. Items that were found reliable were averaged together to form composite mean scores, which were used in analyses to test for changes from Time 1 to Time 2. See Appendix A for all items in each measure, scale labels, and associated alpha levels.

Quantitative results were generated using a paired samples t-test on each outcome measure, treating *Time* as a within-subjects variable. For each statistical test, we indicate whether mean differences from Time 1 to Time 2 is statistically significant using the conventional $p \leq .05$ threshold for inferential statistics. Qualitative data (i.e., open-ended comments) were analyzed using a thematic coding scheme, where patterns among open-ended comments were grouped together and summarized as an over-arching theme or idea.

Evaluation Results

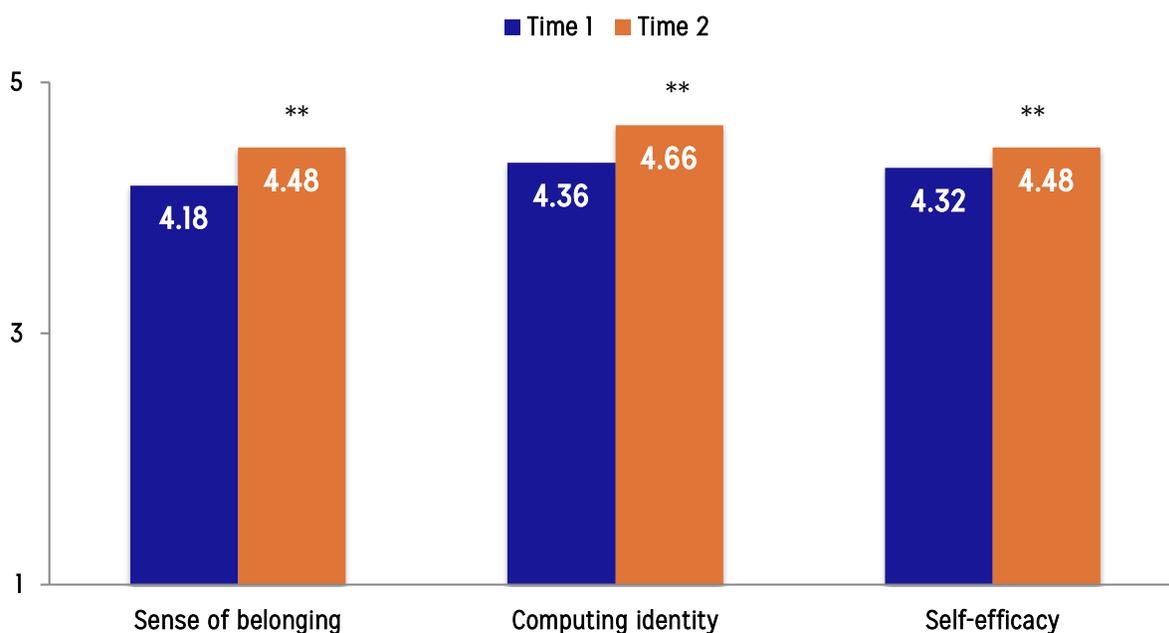
Results presented in this section utilize a pretest-posttest research design, wherein participants' responses at Time 1 (before URMD) are compared against their responses at Time 2 (after URMD). Please see Appendix A for individual items, scales, and reliability scores of each outcome measure discussed below.

Changes from Time 1 to Time 2 for All Participants

One of the overarching goals of the URMD workshop is to help underrepresented students in computing feel a sense of community with their peers and build confidence to persist in their graduate degree programs. To assess whether the URMD workshop met that goal, CERP gauged participants' **sense of belonging, identification with computing, and self-efficacy** in the field of computing.

Using composite measures, Figure 1 displays visualized results that indicate participants reported a statistically significant **increase in all three measures** after attending the URMD workshop. See Figure 1 below for the display of composite means at time 1 and time 2.

Figure 1. Changes in Sense of Belonging, Computing Identity, and Self-efficacy.



Values represent mean responses for each composite item. Responses were given on a five-point scale with higher numbers indicating greater agreement with each item. Statistical significance was determined using paired-samples t-tests. ** $p \leq .01$.

To understand how participants responded to individual items within each composite measure, we examined changes from Time 1 to Time 2 for each belonging, identity, and self-efficacy measure. As shown below in Table 2, participants reported statistically significant increases in all items related to belonging and computing identity.

For self-efficacy, participants reported stronger confidence to discuss theory with senior members in their field and articulate thoughtful answers to theoretical questions about their work during a presentation after attending URMD Grad Cohort. These significant changes make sense in the context of the workshop, as participants had many opportunities to practice discussing their research with senior members and peers.

It is also important to note that as seen by Time 1 mean scores, participants entered URMD Grad Cohort with already strong feelings of belonging, identity, and self-efficacy. In the case of significant findings, results indicate that URMD Grad Cohort may have been able to strengthen those feelings even further.

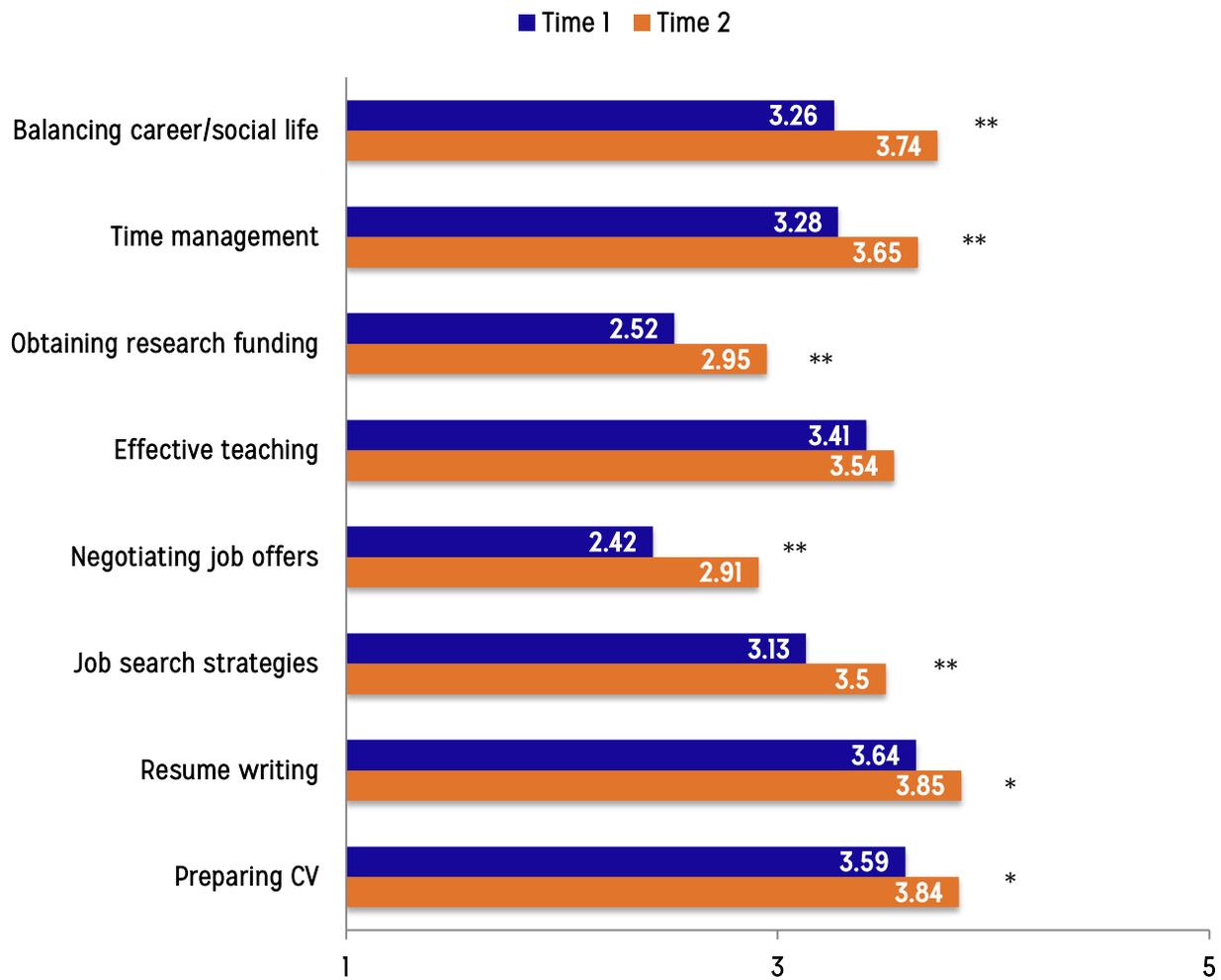
Table 2. Changes in Belonging, Computing Identity, and Self-efficacy by Individual Items.

| | Time 1 | Time 2 |
|--------------------------------------------------------------------------------------------|-------------|---------------|
| Sense of Belonging | | |
| I feel like I belong in computing | 4.33 [.93] | 4.55 [.69] * |
| I feel welcomed in the computing community | 4.04 [1.10] | 4.39 [.84] ** |
| Computing Identity | | |
| I see myself as a “computing person” | 4.41 [.72] | 4.74 [.47] ** |
| Computing is a big part of who I am | 4.31 [.88] | 4.58 [.65] ** |
| Self-efficacy “I am confident that I can...” | | |
| Become an expert in my field | 4.59 [.67] | 4.61 [.67] |
| Complete my department’s milestones towards earning my degree in a timely manner | 4.46 [.86] | 4.59 [.79] |
| Publish in the top journals in my field | 4.29 [.86] | 4.41 [.77] |
| Discuss theory with senior members of my field | 4.06 [.96] | 4.36 [.72] ** |
| Articulate thoughtful answers to theoretical questions about my work during a presentation | 4.19 [.86] | 4.44 [.61] ** |

Notes. Values represent means [and standard deviations] of each item. Responses were given on a five-point scale with higher numbers indicating greater agreement with each item. Statistical significance was determined using paired-samples t-tests. * $p \leq .05$. ** $p \leq .01$.

Another important goal of URMD was to provide tips and tools needed to succeed in graduate school and future computing career trajectories. To measure changes in participants’ **professional skills**, participants rated their knowledge about career-related skills across eight items. As shown in Figure 2, respondents indicated more knowledge about nearly every professional skill measured after the workshop. The exception to this finding was participants’ knowledge about *effective teaching*, wherein participants rated their knowledge about this skill about the same before and after URMD.

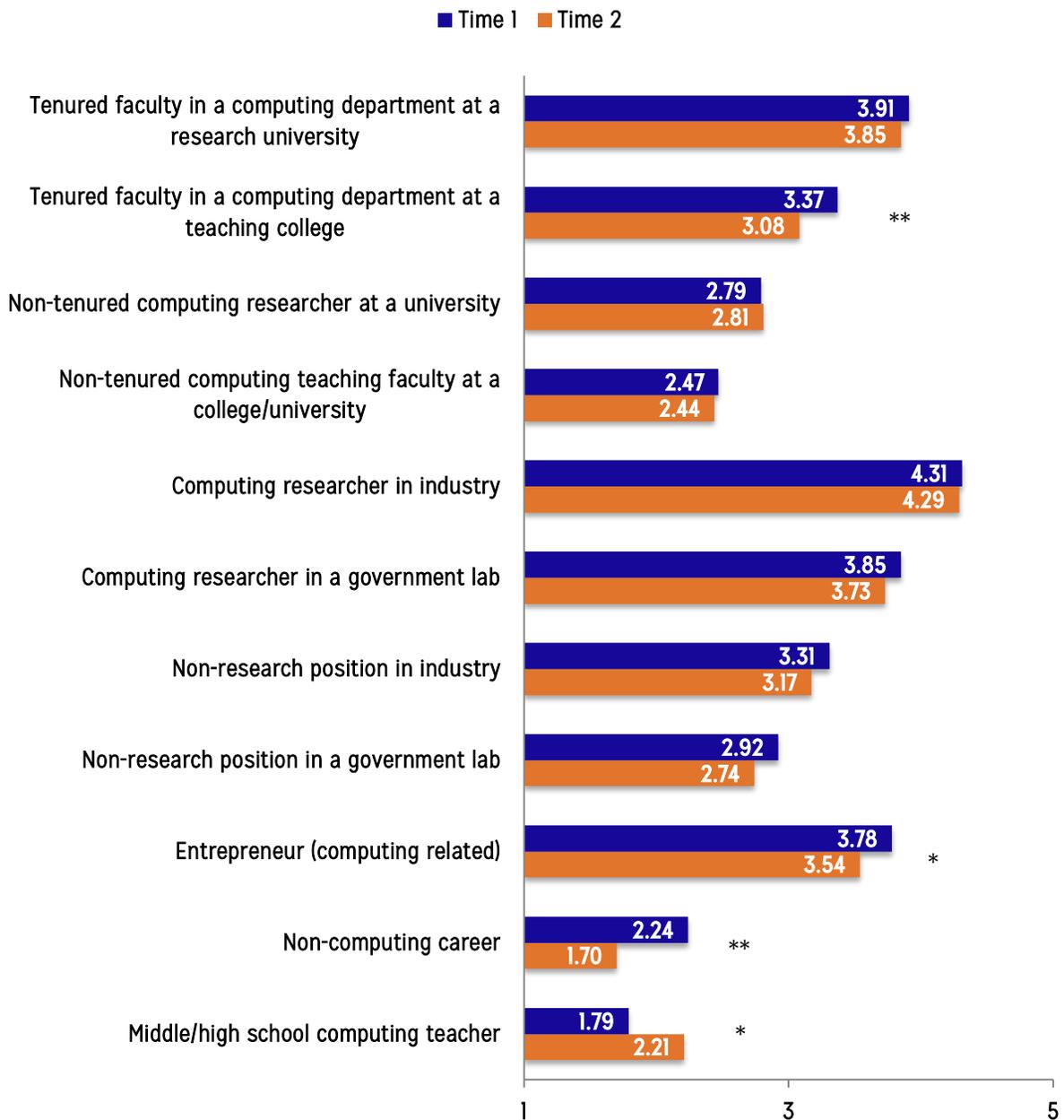
Figure 2. Changes in Professional Skills.



Values represent mean responses for each item. Responses were given on a five-point scale with higher numbers indicating greater knowledge of a particular skill. Statistical significance was determined using paired-samples t-tests. * $p \leq .05$. ** $p \leq .01$.

Finally, URMD Grad Cohort provided an opportunity for participants to hear speakers from a variety of backgrounds and careers. CERP measured whether the workshop made an impact on participants' **career interests**. As seen below in Figure 3, most participants did not report many changes in their career interests; however, participants reported *more interest* in a middle/high school computing teacher position after URMD Grad Cohort. Participants reported *less interest* from Time 1 to Time 2 in the following careers: tenured faculty in a computing department at a teaching college, entrepreneur (computing related), and a non-computing career.

Figure 3. Changes in Career Interests.

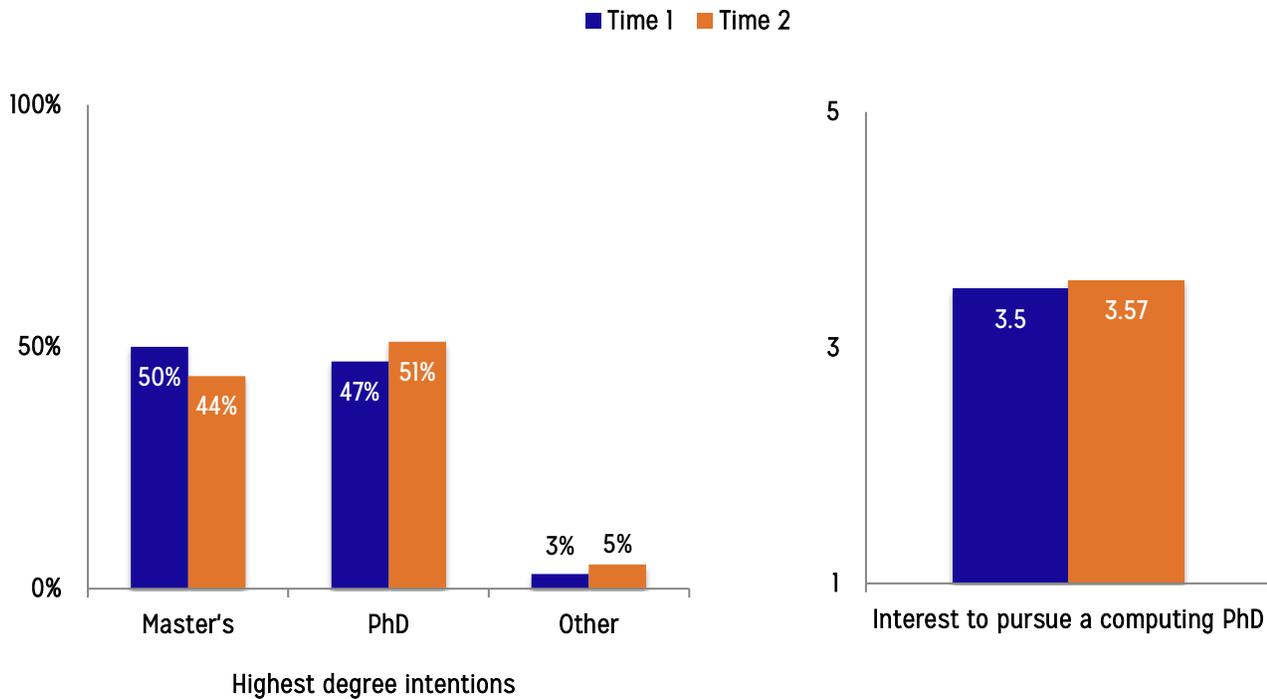


Values represent mean responses for each item. Responses were given on a five-point scale with higher numbers indicating greater interest in a particular career path. Statistical significance was determined using paired-samples t-tests. * $p \leq .05$. ** $p \leq .01$.

Changes from Time 1 to Time 2 for Master's Students Only

To gauge whether URMD Grad Cohort made an immediate impact on participants' degree interests, CERP examined change in master's degree students' ($n = 14$) **highest degree intentions** and **interest to pursue a computing PhD** from Time 1 to Time 2. As displayed below in Figure 4, there were no statistically significant changes over time in participants' degree interests; however, it may be worth noting that two URMD participants changed their highest intended degree from a Master's to a PhD.

Figure 4. Master's Students Changes in Degree Interest.



In the chart on the left, values represent percentage of participants who selected their highest degree choice at Time 1 and Time 2. Statistical significance was determined using Pearson's chi-square test of fit.

In the chart on the right, values represent the mean response for the item. Responses were given on a five-point scale with higher numbers indicating greater interest in pursuing a computing PhD. Statistical significance was determined using paired-samples t-tests.

Summary

Quantitative results measuring changes over time indicate that URMD Grad Cohort had a positive impact on participants' **sense of belonging**, **computing identity**, **self-efficacy**, and **professional skills**. At Time 2, participants were less interested in certain career paths, and master's students reported their degree interests about the same at Time 1 and Time 2.

Feedback Results

This section presents participants' quantitative and qualitative feedback about the workshop. Quantitative feedback is displayed below in frequency tables. Qualitative data were collected via open-ended comments and are summarized below.

Usefulness of Sessions: Day 1

Participants rated the usefulness of each session. Participants who indicated they did not attend a particular session were excluded from analyses. Tables 3.1 and 3.2 display the frequency of ratings for each session held on Day 1 of URMD Grad Cohort, which indicate the majority of attendees rated each session at least somewhat useful. On average, sessions "Networking" and "Industry vs. Academic Research Positions" were rated most useful.

Open-ended comments regarding Day 1 indicate that participants were enthusiastic and satisfied overall with Day 1 sessions. Some participants provided specific suggestions for improvement to Day 1, including:

- Make advice more concrete, especially in sessions "Finding a Research Topic" and "Finding the Help You Need and Deserve"
- Include a woman speaker for session "Balancing Graduate School and Personal Life"
- Provide a separate networking space during the reception to offer a quieter alternative to the dance party

Table 3.1. Usefulness of Day 1 sessions.

| | N | Not at all (1) | Slightly (2) | Somewhat (3) | Quite a bit (4) | Extremely (5) | Mean |
|----------------------------------------------------------------------------------------|----|-------------------|-----------------|-----------------|--------------------|------------------|------|
| <i>Please rate the degree to which you found the following sessions to be useful..</i> | | | | | | | |
| Welcome | 81 | 0% | 1% | 12% | 28% | 58% | 4.43 |
| Parallel Sessions | | | | | | | |
| Networking | 23 | 0% | 0% | 4% | 17% | 78% | 4.74 |
| Finding a Research Topic & Interdisciplinary Research | 23 | 0% | 0% | 17% | 22% | 61% | 4.43 |
| Industry vs. Academic Research Positions | 40 | 0% | 3% | 3% | 15% | 80% | 4.73 |
| Parallel Sessions | | | | | | | |
| Master's vs. Ph.D. | 10 | 0% | 10% | 40% | 10% | 40% | 3.80 |
| Presentation and Other Verbal Communication Skills | 40 | 0% | 0% | 15% | 35% | 50% | 4.35 |

Notes. Values represent percentages within each session. Percentages may not equal 100% due to rounding error. N = number of individuals who provided responses to each item. Day 1 sessions continued in Table 3.2.

Table 3.2. Usefulness of Day 1 sessions.

| | N | Not at all (1) | Slightly (2) | Somewhat (3) | Quite a bit (4) | Extremely (5) | Mean |
|-----------------------------------------------------------------------------------------|----|-------------------|-----------------|-----------------|--------------------|------------------|------|
| <i>Please rate the degree to which you found the following sessions to be useful...</i> | | | | | | | |
| Preparing Your Thesis Proposal and Becoming a Ph.D. Candidate | 40 | 0% | 3% | 15% | 13% | 70% | 4.50 |
| Parallel Sessions | | | | | | | |
| M.S. Career Opportunities and Job Search | 13 | 0% | 8% | 23% | 23% | 46% | 4.08 |
| Finding the Help You Need and Deserve | 35 | 3% | 9% | 14% | 14% | 60% | 4.20 |
| Ph.D. Academic Career Paths and Job Search | 37 | 0% | 3% | 8% | 16% | 73% | 4.59 |
| ACM Sponsored Lunch | 85 | 1% | 8% | 18% | 27% | 46% | 4.08 |
| Parallel Sessions | | | | | | | |
| Finding an Advisor and Developing an Effective Working Relationship | 12 | 0% | 0% | 17% | 25% | 58% | 4.42 |
| Balancing Graduate School and Personal Life | 35 | 3% | 0% | 9% | 31% | 57% | 4.40 |
| Ph.D. Non-Academic Career Paths and Job Search | 40 | 0% | 0% | 8% | 30% | 63% | 4.55 |
| Finding Your Way: Overcoming Cultural Barriers | 77 | 0% | 5% | 1% | 18% | 75% | 4.64 |
| Birds of a Feather | | | | | | | |
| Overcoming Insufficient Academic Preparation: Perceived and Real | 41 | 5% | 2% | 12% | 29% | 51% | 4.20 |
| Empowerment of People with Disabilities | 11 | 0% | 9% | 9% | 18% | 64% | 4.36 |
| Poster Session | 74 | 0% | 4% | 14% | 34% | 49% | 4.27 |
| Reception hosted by Microsoft Research | 85 | 0% | 4% | 12% | 20% | 65% | 4.46 |

Notes. Values represent percentages within each session. Percentages may not equal 100% due to rounding error. N = number of individuals who provided responses to each item.

Usefulness of Sessions: Day 2

Table 4 displays the frequency of ratings for each session held on Day 2 of Grad Cohort, which indicates the majority of attendees rated each session at least somewhat useful. On average, sessions “Building Your Professional Persona” and “Individual Academic/Career Advising” were rated the most useful.

Open-ended comments regarding Day 2 also indicate participants were satisfied overall. In particular, many participants commented positively about the individual advising sessions. Suggestions for improvement regarding Day 2 include the following:

- Make advice more concrete, especially in sessions “Building Your Professional Persona”, “Finding the Help You Need and Deserve”, and “Entrepreneurship Opportunities & Skills”
- Consider moving individual advising to Day 1, so participants can schedule their workshop agenda based on advice learned
- Schedule more time for networking outside of the sessions

Table 4. Usefulness of Day 2 sessions.

| | N | Not at all (1) | Slightly (2) | Somewhat (3) | Quite a bit (4) | Extremely (5) | Mean |
|-----------------------------------------------------------------------------------------|----|-------------------|-----------------|-----------------|--------------------|------------------|------|
| <i>Please rate the degree to which you found the following sessions to be useful...</i> | | | | | | | |
| Strategies for Human-Human Interaction | 83 | 1% | 5% | 5% | 28% | 61% | 4.43 |
| Parallel Sessions | | | | | | | |
| Financing Your Graduate Education | 14 | 0% | 14% | 43% | 14% | 29% | 3.57 |
| Building Your Professional Persona | 42 | 0% | 0% | 17% | 21% | 62% | 4.45 |
| Entrepreneurship Opportunities & Skills | 34 | 3% | 3% | 18% | 18% | 59% | 4.26 |
| Parallel Sessions | | | | | | | |
| Summer Internships | 19 | 0% | 0% | 32% | 26% | 42% | 4.11 |
| Building Self-Confidence | 31 | 0% | 7% | 29% | 29% | 36% | 3.94 |
| Publishing Your Research | 36 | 3% | 3% | 8% | 22% | 64% | 4.42 |
| Wrap-Up & Final Remarks | 80 | 1% | 8% | 11% | 26% | 54% | 4.24 |
| Lunch - Discussion Topic Tables | 83 | 1% | 5% | 16% | 24% | 54% | 4.25 |
| Individual Resume/CV Advising | 20 | 5% | 0% | 15% | 25% | 55% | 4.25 |
| Individual Academic/Career Advising | 25 | 4% | 0% | 0% | 28% | 68% | 4.56 |

Notes. Values represent percentages within each session. Percentages may not equal 100% due to rounding error. N = number of individuals who provided responses to each item.

Overall Workshop Feedback

Respondents provided comments to open-ended questions regarding their favorite aspects of the workshop, as well as suggestions for improvement.

Favorite aspects. Favorite aspects of URMD Grad Cohort cited most frequently included the following:

- Networking with peers and speakers
- The diverse, communal, and judgment-free environment
- Specific sessions, such as “Strategies for Human-Human Interaction”, “Entrepreneurship Opportunities & Skills”, and poster session
- Mentoring and advising from the speakers

Suggestions for improvement. Respondents offered suggestions for improving the URMD Grad Cohort workshop, including suggestions related to additional topic discussions, content improvement, and logistic aspects. Common suggestions included the following:

Suggestions for additional topics:

- Managing professional relationships and dealing with conflict
- Navigating mental health issues in graduate school
- Effective networking and teaching practices
- Best practices for writing research papers
- Resiliency and overcoming failure
- Tips for a smooth transition from student to professional
- Getting involved in leadership and service activities

Content improvement:

- Incorporate more perspectives for master’s students
- Encourage speakers to leave time for Q&A during sessions
- Recruit more speakers from diverse research backgrounds
- Provide concrete advice, rather than general ideas
- Employ the closing session as a “debrief” for final questions, lingering concerns, final tips

Logistic aspects:

- Take a group photo
- Move lunch indoors
- Use smaller, but more, tables for the lunch; participants found it difficult to carry conversations at the large tables. Ensure there is plenty of physical space around tables.
- Video record sessions so that attendees can watch sessions they were unable to attend
- Consider scheduling one-on-one mentoring throughout the conference, rather than at the end
- Create a separate Facebook group for URMD participants
- Schedule more time for breaks, or an organized peer-bonding activity
- Add hobbies & group-specific lunch table topics
- Add more variety of food options at breaks and meals

Disability-related Comments. As seen in Table 1, about a quarter of URMD Grad Cohort participants identified as having a disability. During CERP's analysis of open-ended comments, CERP extracted comments specifically related to disability and experiences in the workshop. When asked if their needs were met as a person with a disability, many participants expressed that accommodations provided by staff were sufficient and helpful. On the flip side, participants with disabilities also indicated room for improvement. Suggestions included the following:

- Include some sessions that cover disability-specific topics
- Build in additional breaks, as well as longer breaks
- Video record sessions
- Allow more physical room around tables during meals, and use smaller tables so conversation can be heard
- Allow more physical space in the session rooms, and provide specific seating at the front and back of the rooms that is clearly labeled for students with disabilities
- Ensure there is an accessible agenda for students with screen readers

The suggestions above summarize suggestions related to disability and accommodations; however, because some of the needs are very specific, full responses from these participants providing suggestions for improvement are listed in Appendix B.

Whova-related Comments. Very few participants commented about Whova specifically; however, those who did noted the following:

- Whova was a useful resource during the workshop
- Whova was not accessible for some students with disabilities

Summary

Open-ended comments left by participants indicate that overall, participants were satisfied with their experiences in the workshop. Participants were particularly enthusiastic about the opportunities to build a network of peers and mentors, and the overall welcoming environment of the workshop. Participants provided several suggestions for improvement to the workshop, such as additional session and lunch topics, more time for Q&A, and increased accessibility for students with disabilities.

Recommendations

This section provides specific recommendations for workshop leadership to consider based on evaluation findings discussed in this report.

Increase Accessibility for Students with Disabilities

A large portion of participants was enthusiastic and impressed by CRA's efforts for an inclusive and accessible workshop. Participants also expressed there was room for improvement, such as providing more physical space around lunch tables and in sessions, dedicating more space in sessions for students with disabilities (beyond the back of the room) with reserved markers, scheduling more breaks and time between sessions, video recording sessions and proving slides early, and ensuring an accessible agenda is available for students with screen readers. See Appendix B for comments left by participants related to suggestions for improvement to accessibility for students with disabilities.

Record Sessions

Participants were enthusiastic about the session topics, but expressed interest in attending sessions occurring simultaneously. While slides are provided after the workshop is over, attendees do not get to hear the presentation from the speaker or questions posed by the audience. Further, students with disabilities may benefit from recorded sessions, because certain disabilities hinder their ability to process information at one time. As also indicated in open-ended comments, some students with disabilities require more breaks, which could mean missing the occasional session. Workshop organizers should consider recording sessions and making visual or audio recordings available to attendees of the workshop.

It is important to note that while recordings would be beneficial for attendees, it is possible participants may not feel as free to share their experiences knowing their issues will go "on record." As such, organizers should consider limiting availability of recordings to only attendees, and set a time limit on how long recorded sessions are available. For example, if organizers decide recordings are only available one month after the event and will be deleted thereafter, make this information clear to attendees.

Consider Additional Topics

URMD Grad Cohort participants left several suggestions for additional topics and content improvement for future workshops. For example, master's students and students with disabilities expressed a need for more relevant content related to their needs. Because much of the session content can be applied to all students, organizers can also consider adding group-specific topics to lunch tables or create more special break-out groups.

It will also be important to emphasize future events that participants could benefit from a bit later in their career, such as the CRA-W Early Career Mentoring Workshops, or the CRA Career Mentoring Workshops.

Take a Group Photo

Several participants (and even speakers) felt that a group photo should have been taken. While this is a seemingly small recommendation, taking a group photo furthers the workshops' mission of creating a communal and welcoming space for attendees of diverse backgrounds and experiences.

Conclusion

The CRA URMD Grad Cohort workshop was designed with the successful CRA-W Grad Cohort workshop in mind: URMD Grad Cohort strived to provide a welcoming environment for underrepresented racial minorities and persons with disabilities to build a network of peers and mentors, and build professional skills needs for success in computing graduate degree programs and future careers. Evaluation results in this report suggest URMD Grad Cohort made a positive immediate impact on participants. Compared to before the workshop, participants reported a stronger sense of belonging in computing, computing identity, self-efficacy in computing, and professional skills. Open-ended comments also indicate participants enjoyed their experience in the workshop. Participants were enthusiastic over the inclusive and welcoming atmosphere URMD Grad Cohort provided, and they rated the sessions as quite useful overall.

Participants also provided suggestions for improving URMD Grad Cohort, including new topic discussions, improvements to the current content, and logistic aspects. It is important to note that speakers also reflected some suggestions left by participants. See CERP's speaker evaluation report for more information. CERP's recommendations for workshop organizers included increasing accessibility of the workshop for students with disabilities, recording sessions, considering additional topics and group-specific discussions, and taking a group photo. CERP will follow up with URMD Grad Cohort participants a year after the event to measure any long-term impacts of the workshop on students' outcomes as they related to the goals of the program.

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Appendix A: Survey Measures

Reliability was determined for multi-item constructs using Cronbach's alpha (α). Alpha levels $\geq .70$ are considered acceptable. Items for each construct were averaged together to form composite scores. Individual items are listed below.

Sense of Belonging in Computing

Participants' sense of belonging in the computing community was assessed with two items. Items were averaged to form a composite score ($\alpha = .76$ at Time 1 and $\alpha = .77$ at Time 2). Individual items are listed below.

Rate the degree to which you disagree or agree with the following statements:

- I feel like I 'belong' in computing
- I feel welcomed in the computing community

| | | | | |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|
| Strongly disagree (1) | Disagree (2) | Neither agree nor disagree (3) | Agree (4) | Strongly agree (5) |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|

Computing Identity

Participants' sense of identity with computing was assessed with two items. Items were averaged to form a composite score ($\alpha = .85$ at Time 1 and $\alpha = .70$ at Time 2). Individual items are listed below.

Rate the degree to which you disagree or agree with the following statements:

- I see myself as a 'computing person'
- Computing is a big part of who I am

| | | | | |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|
| Strongly disagree (1) | Disagree (2) | Neither agree nor disagree (3) | Agree (4) | Strongly agree (5) |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|

Self-efficacy in Computing

Participants' self-efficacy in computing research was assessed with five items. Items were averaged to form a composite score ($\alpha = .81$ at Time 1 and $\alpha = .81$ at Time 2). Individual items are listed below.

I am confident that I can...

- Become an expert in my field
- Complete my department's milestones towards earning my degree in a timely manner
- Publish in the top journals in my field
- Discuss theory with senior members of your field
- Articulate thoughtful answers to theoretical questions about your work during a presentation

| | | | | |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|
| Strongly disagree (1) | Disagree (2) | Neither agree nor disagree (3) | Agree (4) | Strongly agree (5) |
|--------------------------|-----------------|-----------------------------------|--------------|-----------------------|

Professional Development Skills

Participants reported on their knowledge about career-related aspects with eight items. Individual items are listed below.

How would you rate your knowledge of each of the following, from very poor to very strong?

- Preparing my curriculum vitae
- Resume writing
- Job search strategies
- Negotiating job offers
- Effective teaching
- Obtaining funding for research
- Time management strategies
- How to balance my career and social life

| | | | | |
|---------------|-------------------|-------------|-------------------|-----------------|
| Very poor (1) | Below average (2) | Average (3) | Above average (4) | Very strong (5) |
|---------------|-------------------|-------------|-------------------|-----------------|

Career Interests

Participants reported their interest in 11 career paths. Individual items are listed below.

How interested are you in the following careers?

- Tenured faculty in a computing department at a research university
- Tenured faculty in a computing department at a teaching college
- Non-tenured computing researcher at a university
- Non-tenured computing teaching faculty at a college/university
- Computing researcher in industry
- Computing researcher in a government lab
- Non-research position in industry
- Non-research position in a government lab
- Entrepreneur (computing related)
- Non-computing career
- Middle/high school computing teacher

| | | | | |
|--------------------------|---------------------|-----------------------------------------------|-------------------|------------------------|
| Very uninterested (1) | Uninterested (2) | Neither uninterested nor interested (3) | Interested (4) | Very interested (5) |
|--------------------------|---------------------|-----------------------------------------------|-------------------|------------------------|

For master's students only:

Interest in Pursuing a Computing PhD

How interested are you in ultimately pursuing a PhD in a computing field?

| | | | | |
|----------------|--------------|--------------|-----------------|---------------|
| Not at all (1) | A little (2) | Somewhat (3) | Quite a bit (4) | Extremely (5) |
|----------------|--------------|--------------|-----------------|---------------|

Highest Degree Intentions

What is the highest degree you plan to attain?

- Master's degree
- Doctoral degree
- Professional degree

Appendix B: Disability-related Suggestions for Improvement

The open-ended comments below are quoted directly from participants who left feedback related to suggestions for improving URMD Grad Cohort in regards to accessibility and inclusiveness for students with disabilities. Note that some of these suggestions may have come from the same participant—suggestions below were aggregated from comments left in all open-ended questions.

1. There are a variety of disability-specific topics that I would like to see. (I realize them may not have been a critical mass of students with disabilities in attendance this year, but hopefully we will get there in the future!) Specifically,
 - resources for solving the technical problems that arise as a student with a disability in computing
 - knowing when to ask for help
 - funding for assistive technology and services
 - finding/building community when you are the only student with a disability in your program/department/school (maybe this is an issue for other minority groups too, but I didn't get that impression when speaking with other students and mentors in attendance)
 - knowing your rights under the law and what to do when they aren't respected (again, maybe this applies more broadly)
 - accepting your limitations while still being proud of your work
 - communicating about your disability in a way that is professional and maintains focus on your strengths"
2. The [Whova] application was not accessible (using a screen reader), so I felt like I was missing out on participating. The Google reception was fun, but the music made it difficult to socialize.
3. Since I struggle with ADD, having a video recording would help me review what I missed
4. The lunch was a bit inaccessible because it was hard to get a wheelchair through the tables. Also, there wasn't much conversation at least at my table. Conversation starters for the specific table topic would be helpful.
5. [My needs were] mostly met. It would be helpful to have specific people to go to for help getting food. Also, the tables at lunch were very close together, making it hard to get around to many of the tables, restricting the topic I could participate in.
6. Maybe educate participants without disabilities how to help or interact better with people with disabilities. Help us to help them if it is necessary.
7. I thought the accommodations were very good and well thought out. In the future, I would recommend scheduled down time. Fatigue is a real and annoying part of disability.

8. I do not identify as a person with disabilities, but as an ally of the community, I would like to express how disappointed I am that the agenda was not screen reader accessible. Luckily, my colleague could confide in me and ask me to report the agenda as they could not read it themselves.

Not only is that disappointing, but very embarrassing as this conference was supposed to be a space that welcomed diversity. I would *HIGHLY* recommend the organizers test the accommodations for our peers with disabilities in order to foster inclusion.

Also, I would recommend having an outlet for individuals to anonymously report any general needs throughout the conference. My colleague was very hesitant to speak to the organizers about the accessibility issue.

9. I appreciated the helpful staff (both CRA and the hotel), I never felt like I was not able to participate. The only accessibility problem was the application used to organize and communicate during the conference.
10. The hotel staff running the food for the ACM lunch said some comments when I asked for help getting food that made me uncomfortable and that they had to "take care" of me. The CRA staff were very helpful.
11. At meals, the tables were too big to allow for a single conversation at a table in most cases. They were also too close together, leading to a high noise level in the room. Consider spreading out across multiple rooms for meals. (To give a concrete example of why this is a problem: I had breakfast one morning at a table with a hard of hearing participant. For about the first 15 minutes of the meal, she was involved in a conversation with myself and a few other students. As the room filled up and the noise level increased, she told us that there was too much background noise and she would have to drop out of the conversation.)

Consider allowing more downtime. While some of the sessions were quite useful, I think the best part of this workshop was the opportunity for networking with peers and mentors. And I didn't have the opportunity to meet everyone that I wanted to. I would prefer fewer sessions with more/longer breaks for networking. Additionally, more downtime allows students with disabilities and chronic health conditions time to rest and perform any necessary health-related activities (take medications, check blood glucose, stretch, etc.)

Several months before the workshop, I requested several accommodations related to my disability. Some of them were taken care of, but some were not. For example, I requested a stool to sit on during the poster session, so I would not have to stand for over an hour while presenting my poster. That stool was not provided for me, and I actually couldn't find a single CRA staff member in the room where the poster session was being held to ask for assistance. If you want this event to be welcoming for students with disabilities, then taking their accommodation requests seriously is crucial. (And if there are some accommodations you know you won't be able to provide, then please tell students so that they can make other arrangements or perhaps decide that they don't want to participate.)

12. (I put a lot of relevant information in the previous question, also.)

I have a disability that affects my mobility, dexterity, and sensory processing abilities.

The hotel room I was assigned was excellent. I especially appreciate the bathroom with shower chair, movable showerhead, and grab bars.

I received polite and helpful assistance from CRA staff and other attendees with tasks like opening doors, carrying a plate through the buffet line, and moving chairs.

However, I also requested some accommodations that I did not receive. In particular, I asked for a stool to sit on during the poster session. This seems like a very simple and reasonable accommodation, but no stool was provided for me, and I couldn't even find a CRA staff member to ask at the beginning of the poster session.

I would suggest two things:

1. Put in a serious effort to organize and track accommodation requests from students and other participants. I think some of my requests were simply lost in someone's email inbox.
2. Provide a contact point for participants who run into problems during the event. I would suggest a simple phone number that we can call/text. Remember that it is not always easy for us to just go find a staff member. (Mobility limitations make it hard to move around in a crowd. Blind students can't see nametags. Deaf students without an interpreter have to write things down to communicate. Chronic health conditions and resulting fatigue can make it costly to wander around looking for someone. Etc.)

There were also some challenges arising from how the workshop was organized and/or the physical use of space. Based on those experiences, here are some further recommendations:

1. Provide some disability-friendly seating near the front of each room, as well, making sure that a clear path is available to reach this seating area. I sometimes had difficulty participating in sessions due to sitting at the very back of the room.
 2. Label your disability-friendly seating so that other [participants will not take them]
- 13.** I got very inspired to help and contribute to some of the projects that were presented involving accessibility and disability related studies. So, it would be cool if there were a repository of projects for increasing accessibility where we can volunteer some of our time, maybe coding time or contribute some how.

Maybe one of the dinner settings could be based on hobbies or something not related to research just to cool down a little.

Whova was very useful, but it was not accessible for some students with disabilities

14. I really liked the idea of themed lunch tables (in this case, by research area), but a couple of factors made it not work so well in practice. First, the tables were really too big to have a single conversation. I think twice the number of tables with half the size would have been better. Second, some tables became overcrowded while others had very few people. I know I indicated my research area on the registration survey; perhaps this information could be used to decide how many tables to devote to each research area.

The reception sponsored by Google on Friday night was extremely loud. I have sensory processing difficulties, and I could not stand to be in that room for more than about 10 minutes. The time I did spend there was quite unpleasant. Even the tables outside of the main room were close enough to be quite loud. I ended up sitting on the floor in the hallway some distance down the hall in order to not feel like I needed to wear earplugs (and to be able to hear other people speak). It would be really nice to have a quieter option for people who prefer that (hard of hearing participants and participants with sensory processing disorders would especially benefit, but I suspect many people would simply prefer to have the option).

Appendix C: Evaluation Results for Cognitive Measures by Gender

In this Appendix, we present tables for each cognitive measure (sense of belonging, computing identity, and self-efficacy) displaying changes in means from Time 1 to Time 2 by gender. Statistical significance was determined using repeated measures ANOVA, wherein **Time** was treated as a *within-subjects variable* and **Gender** (men vs women only) was treated as a *between-subjects variable*. All results are discussed below and displayed in Table 1C on page 29.

- If there is an **effect of Time**, the mean score for Time 1 and the mean score for Time 2 are statistically different regardless of gender. These results are the central focus of the main report, and as such, are not further in detail here.
- If there is an **effect of Gender**, the average mean score between Time 1 and Time 2 is different for men and women, regardless of time. In the instance of this finding, means in both Time 1 and Time 2 are emboldened for the corresponding significant group.
- If there is an **interaction effect**, the mean difference between Time 1 and Time 2 is different for men and women. For example, we might observe that changes over time for a particular measure was actually driven by men participants, and there were no changes for women participants. In the instance of this finding, Time 2 means are marked with (*) or (**) to signify statistical differences in Time for the corresponding group.

Sense of Belonging

Results show an effect of time ($F(1,75) = 6.72, p \leq .01$), signifying that all participants reported stronger belonging at Time 2.

An effect of gender ($F(1,75) = 6.10, p \leq .05$) indicated that women had, on average between Time 1 and Time 2, lower belonging than men (Mean difference (MD) = 0.39, $p \leq .05$).

An interaction effect ($F(1,75) = 5.06, p \leq .05$) revealed that women, but not men, reported a significant increase in their sense of belonging from Time 1 to Time 2 ($F(1,75) = 14.56, p \leq .01$). Further, while women had a significantly lower sense of belonging at Time 1 ($F(1,75) = 8.81, p \leq .01, MD = .60$), those differences disappear at Time 2 ($F(1,75) = 1.20, p = .28, MD = .18$).

Computing Identity

Results show an effect of time ($F(1,75) = 13.22, p \leq .01$), signifying that all participants reported stronger identification with computing at Time 2.

A marginal interaction effect ($F(1,75) = 3.04, p = .09$) revealed that women, but not men, reported a significant increase in their computing identity from Time 1 to Time 2 ($F(1,75) = 17.97, p \leq .01$). Differences between men and women at Time 1 indicated women reported lower computing identity, but that effect was not significant ($F(1,75) = 2.82, p = .097, MD = .293$). However, it is worth noting that at Time 2, the marginal effect completely disappears and women and men's levels of computing identity at Time 2 are statistically equal ($F(1,75) = 0.05, p = .83, MD = .03$) with virtually no difference in means.

Self-efficacy

Results show an effect of time ($F(1,75) = 6.07, p \leq .05$), signifying that all participants reported stronger self-efficacy at Time 2.

An effect of gender ($F(1,75) = 8.36, p \leq .01$) indicated that women had, on average between Time 1 and Time 2, lower self-efficacy than men ($MD = 0.34, p \leq .01$).

An interaction effect ($F(1,75) = 5.53, p \leq .05$) revealed that women, but not men, reported a significant increase in their self-efficacy from Time 1 to Time 2 ($F(1,75) = 14.40, p \leq .01$). Further, while women had a significantly lower self-efficacy at Time 1 ($F(1,75) = 11.35, p \leq .01, MD = .47$), those differences nearly-significantly disappear at Time 2 ($F(1,75) = 2.92, p = .09, MD = .20$).

Table 1C. Changes in Sense of Belonging, Computing Identity, and Self-efficacy Composite Measures by Gender

| | Time 1 | Time 2 | Time 1 | Time 2 |
|----------------------------------------|---------------------------|------------|-----------------------------|---------------|
| | Men Participants (N = 31) | | Women Participants (N = 46) | |
| Sense of Belonging (composite measure) | 4.55 [.69] | 4.58 [.55] | 3.95 [.98] | 4.40 [.79] ** |
| Computing Identity (composite measure) | 4.53 [.53] | 4.68 [.46] | 4.24 [.87] | 4.65 [.51] ** |
| Self-efficacy (composite measure) | 4.61 [.45] | 4.61 [.43] | 4.13 [.69] | 4.41 [.56] ** |

Notes. Values represent means [and standard deviations] of each item by time and gender. Responses were given on a five-point scale, and individual items within each cognitive construct were averaged together to form a composite score. Higher numbers indicate stronger levels of each composite measure. Statistical significance was determined using repeated measures ANOVA. ** $p \leq .01$; statistical significance over time is for one group and not the other. N = number of individuals within each group.

Discussion and Summary

In this ad-hoc analysis, CERP found that for URMD Grad Cohort, changes over time in belonging, computing identity, and self-efficacy discussed in this evaluation report were driven primarily by women participants. For men, their reported belonging, computing identity, and self-efficacy were statistically similar both before the workshop and after the workshop. Women also reported lower belonging, identity, and self-efficacy than men before the workshop, but those differences disappeared after attending URMD Grad Cohort. These findings are particularly important because not only do they reveal that women participants may benefit the most from URMD Grad Cohort, they also reveal that the workshop boosted women's cognitive outcomes enough that there were no gender differences at Time 2.

It is important to note that while these findings are particularly riveting, URMD Grad Cohort is a new initiative. It is possible that this finding will only hold true for the inaugural year of the workshop. These findings also do not reveal any differences by racial/ethnic identity or by disability status. As CERP collects a couple years' worth of data, data can be aggregated to form larger sample sizes to study differences among different types of students who attend URMD Grad Cohort.



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