

TAULBEE, TALENT, & TRENDS

Computing Research Association

Uniting industry, academia, and government to advance computing research and change the world.

Taulbee - Betsy Bizot

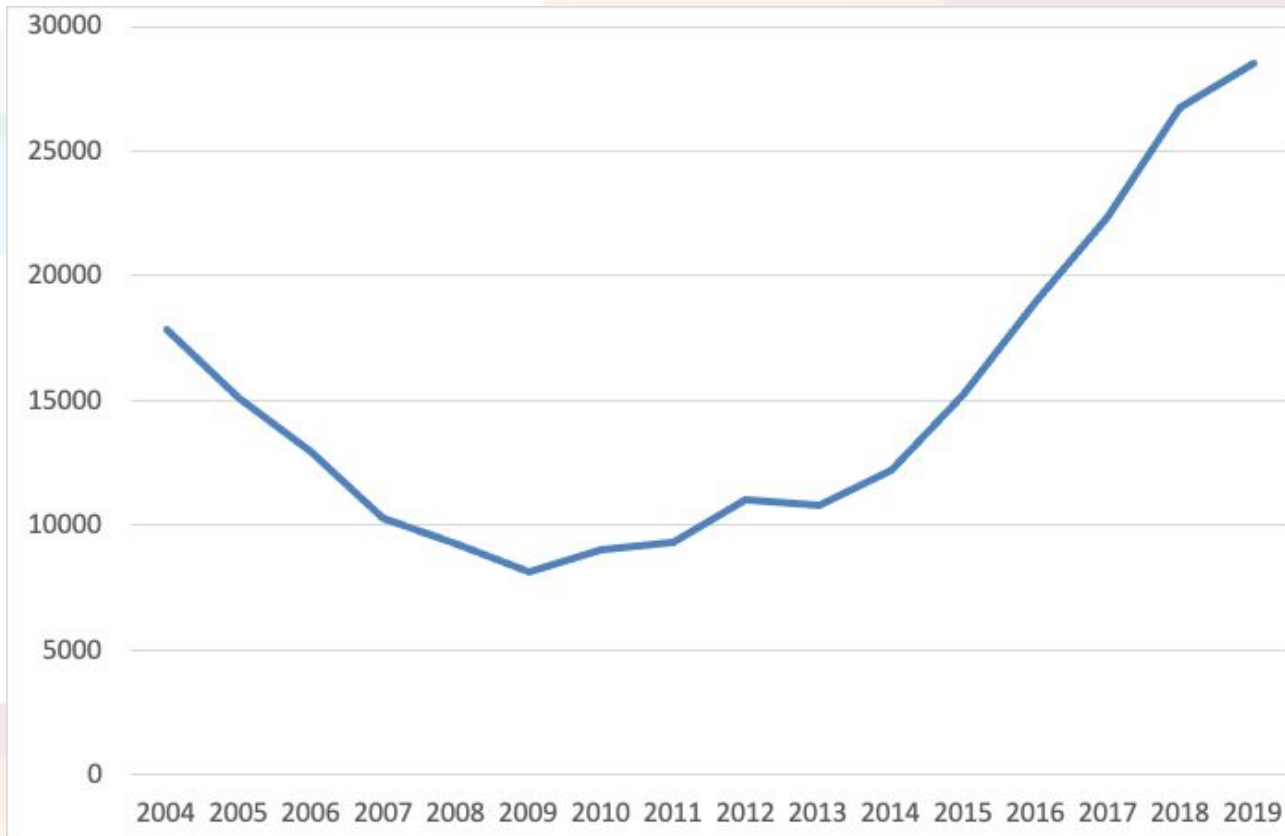
Talent - Sandhya Dwarkadas, Erik Russell, and Amanda Stent

Trends - Burçin Tamer

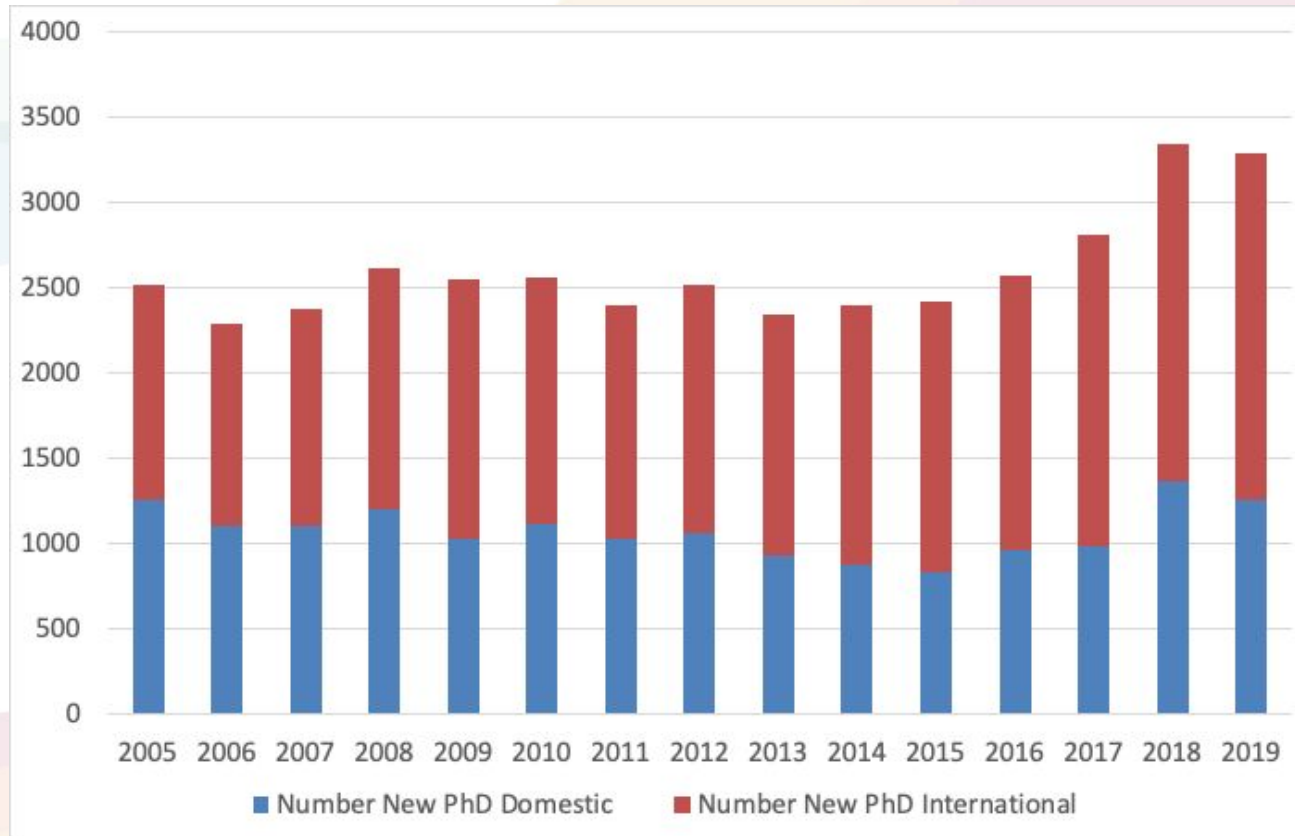


TAULBEE

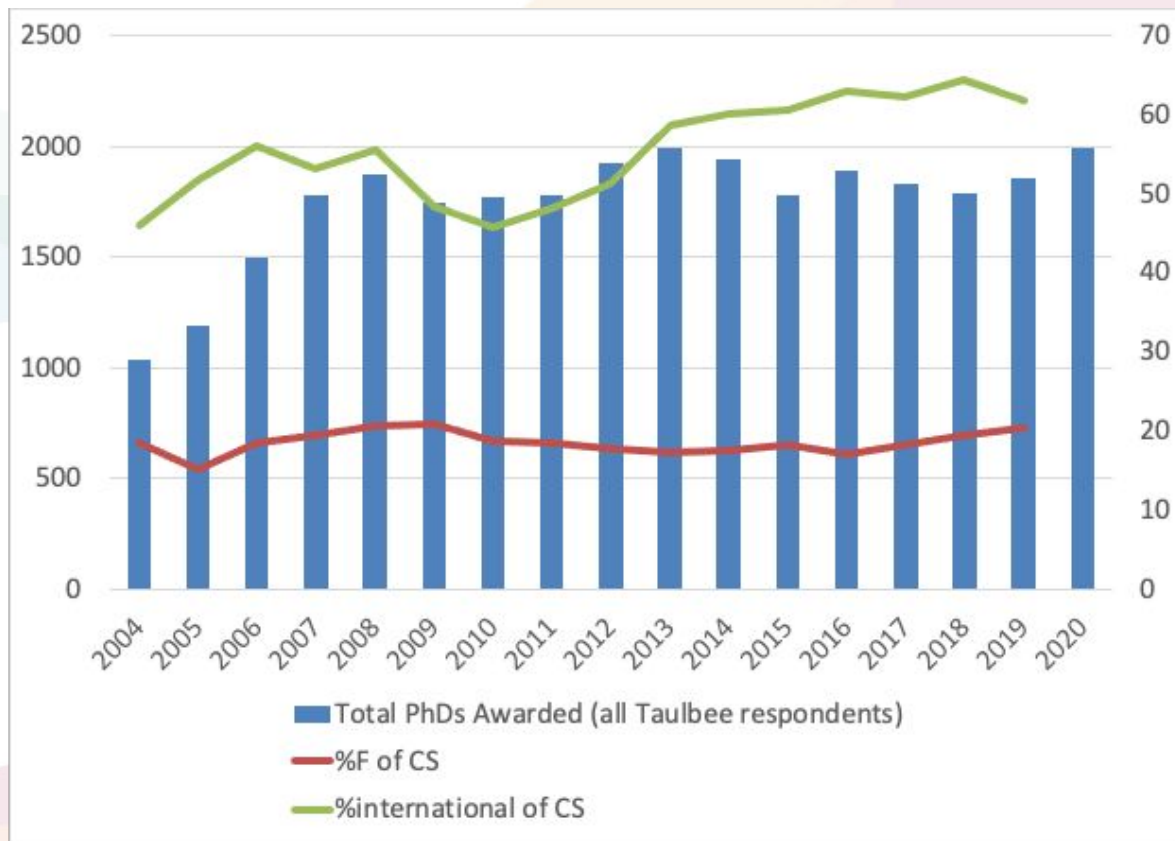
CS Undergraduate Degrees Awarded in Doctoral Institutions



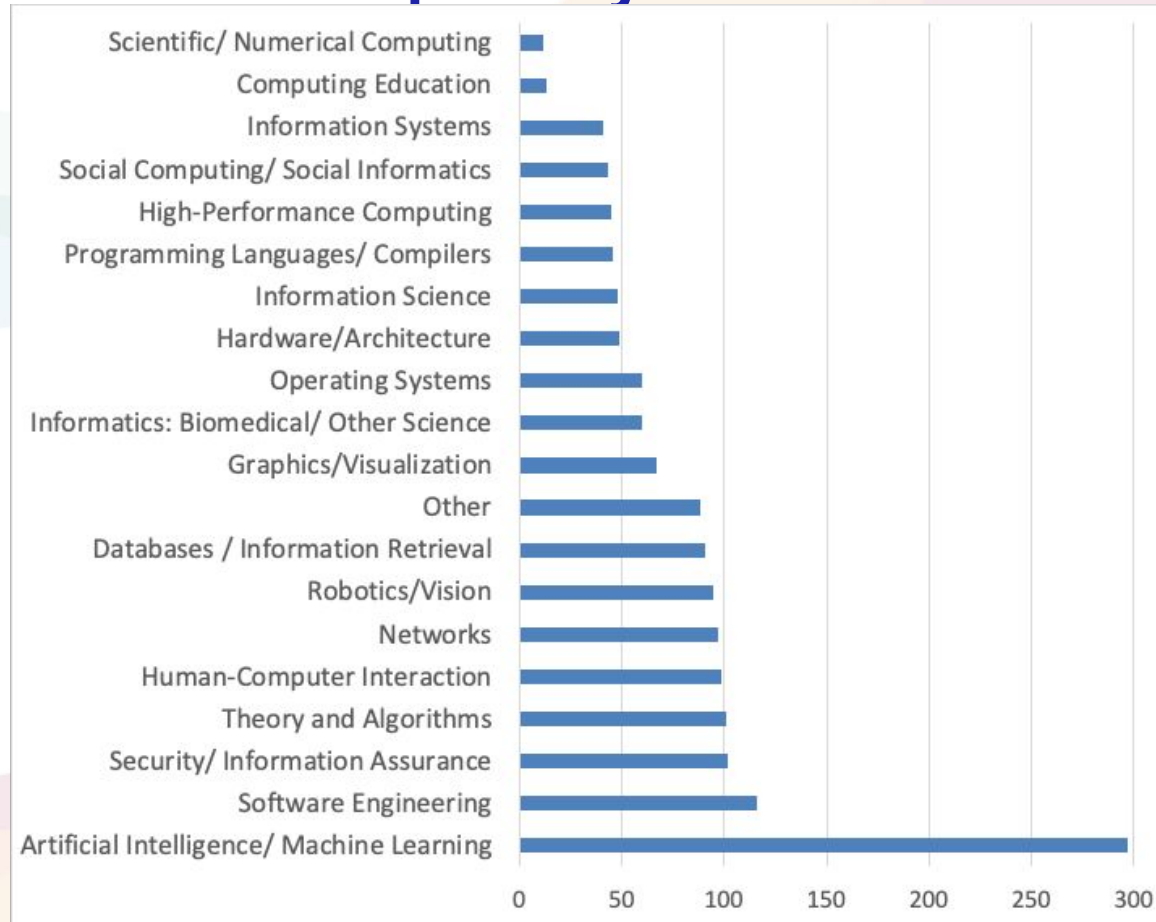
New PhD Enrollment in CS Programs



PhDs Awarded, %Women and %International



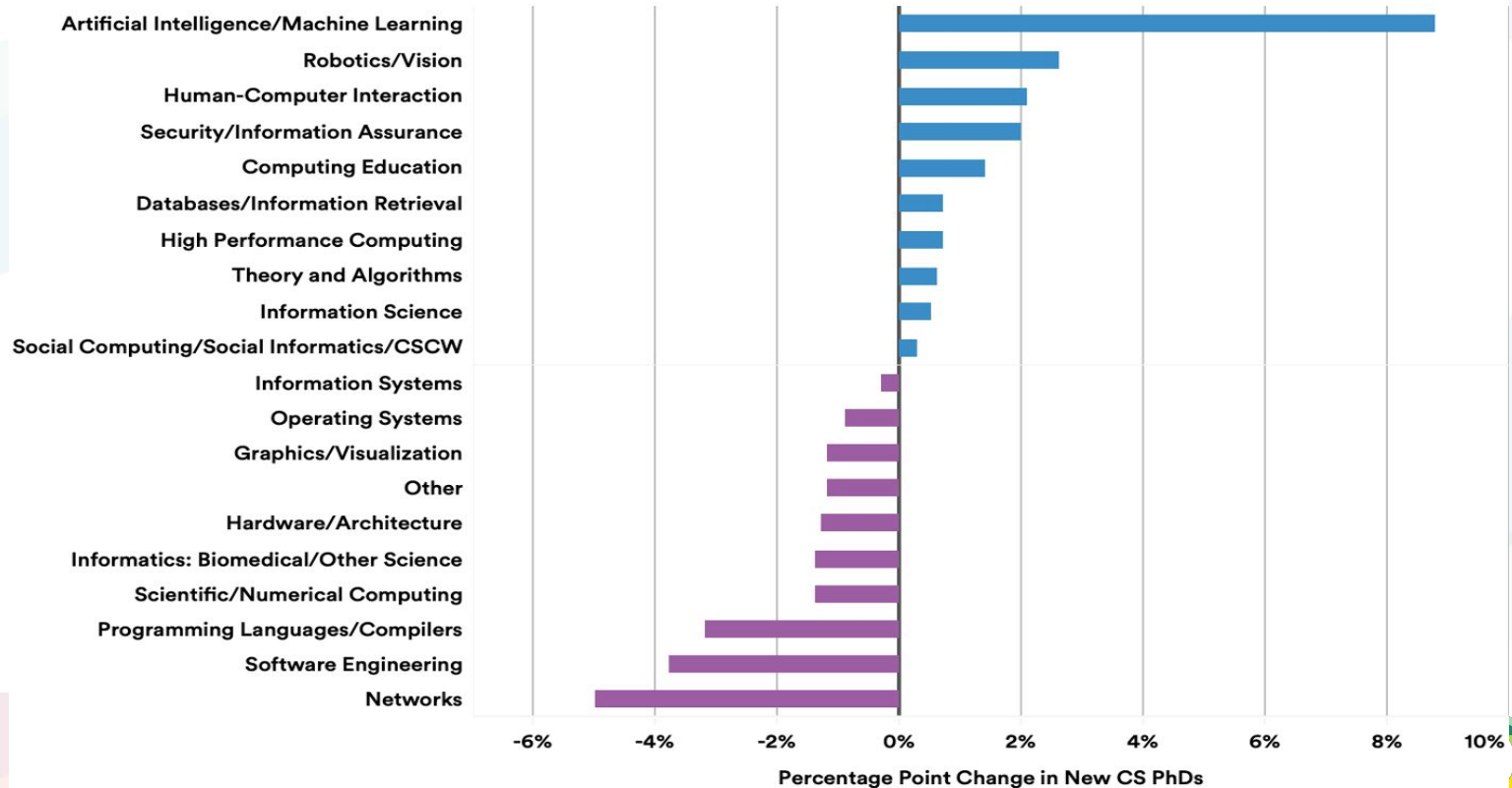
PhD Specialty Areas 2020



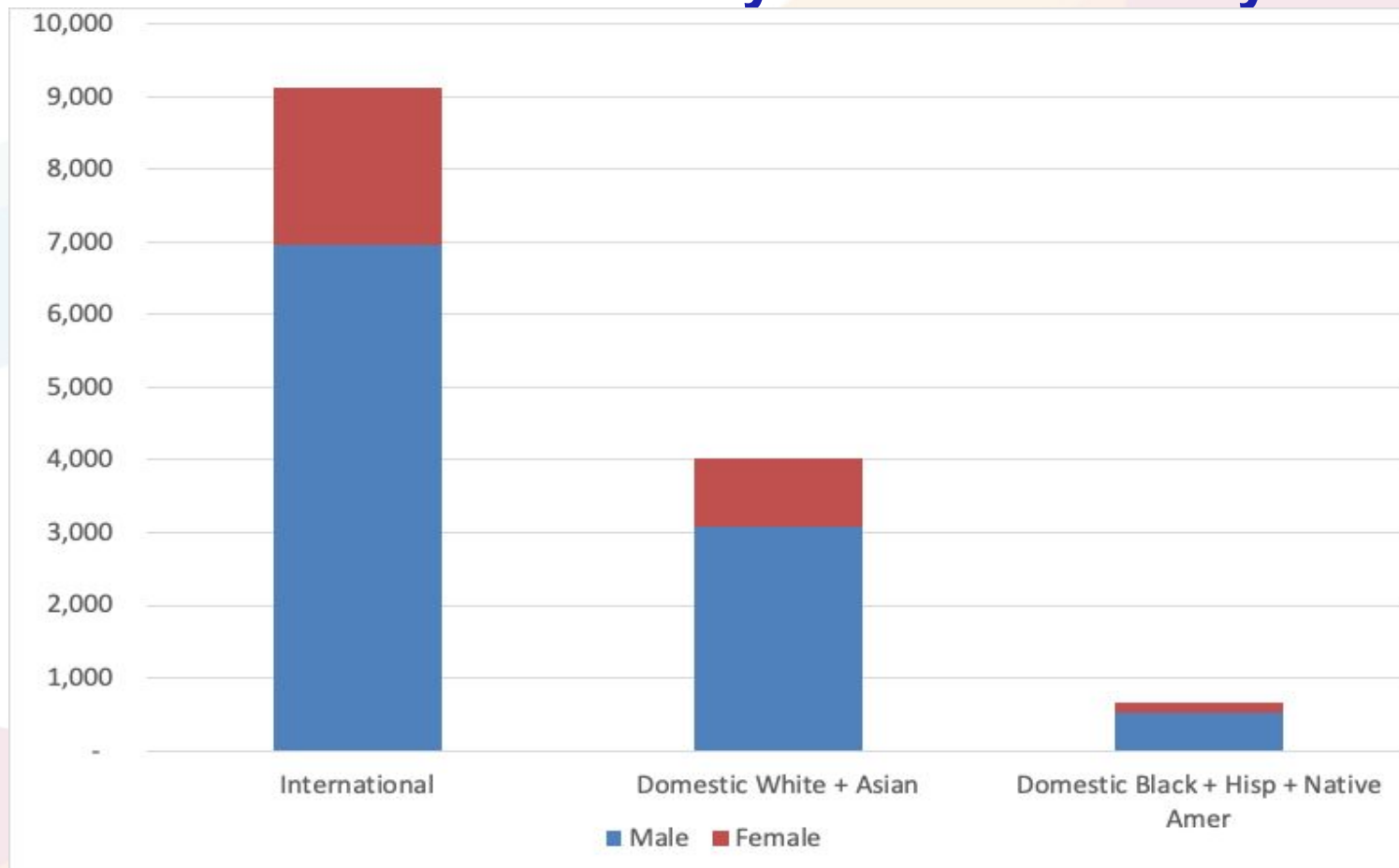
Trends in PhD Specialty Areas

PERCENTAGE POINT CHANGE in NEW CS PHDS in the UNITED STATES from 2010 to 2019 by SPECIALTY

Source: CRA Taulbee Survey, 2020 | Chart: 2021 AI Index Report



PhD Enrollment by Gender/Ethnicity 2020





TALENT

CRA-WP

The CRA Committee on Widening
Participation in Computing Research



CRA-WP

Computing Research Association
Widening Participation

CRA-WP Mission

To widen the participation and improve the access, opportunities, and positive experiences of individuals from populations underrepresented in computing research and education.

Individuals we serve include those who identify as:

- Women
- Black / African American
- Native American / Alaskan Native / Pacific Islander
- Hispanic / Latinx
- Lesbian, Gay, Bi-Sexual, Trans, Queer, Asexual, Intersex, and others
- Persons with disabilities
- Veterans



CRA-WP

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Widening Participation

Who We Are and How We Do It

CRA-WP Board

- Approximately 30 practicing CS researchers
- Each board member is responsible for helping run at least one project
- Do this work as volunteers

Many Additional Volunteers

- Scientists from academia, industry, and national labs
- Senior leaders, as well as mid and early career researchers for workshops focusing on early career mentoring

CRA Staff full-time on CRA-WP

- Erik Russell, Director of Programs (erik@cra.org)
- Leads all CRA-WP operations, coordinates staff and volunteers, performs outreach to funding agencies and operational partners.
- Daniela Cardenas, Program Associate (dcardenas@cra.org)
- Alejandra Guzman, Program Associate (aguzman@cra.org)
- Elyse Okwu, Program Associate (elyse@cra.org)



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Computing Research Association
Widening Participation

CRA-WP: an action-oriented board

Individual and group research and career mentoring, community building, and recognition.

- **Undergrads:** Undergraduate Research Experiences (DREU), Information Security Scholarships (SWSIS), GHC programs
- **Grad Students:** Grad Cohort for IDEALS & Grad Cohort for Women, Career Mentoring Workshops (CMW), SWSIS, GHC programs
- **PhD Researchers:** CMW, GHC programs, BECA and Skip Ellis Awards, Travel Support



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Widening Participation

DOE Support

- Graduate Students
- PostDocs
- Early-Career Faculty
- Mid-Career Faculty

Providing skills, advice, and opportunities to strengthen professional networks and establish both peer and mentoring communities.

Award	Program(s)	Begin	End
DE-SC0016684	Grad Cohort Workshop for Women	4/15/2016	4/14/2019
DE-SC0019321	Career Mentoring Workshop	9/1/2018	8/31/2021
DE-SC0019754	Grad Cohort Workshop for IDEALS and Grad Cohort Workshop for Women	7/31/2019	4/14/2020
DE-SC0021328	Grad Cohort Workshop for IDEALS and Grad Cohort Workshop for Women	9/1/2020	8/31/2022



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Widening Participation

Grad Cohort Workshop for Inclusion, Diversity, Equity, Accessibility, and Leadership Skills (IDEALS)

Goals:

Mentor individuals from populations underrepresented in graduate school in computing

- Provide Ph.D. and M.S. students with **research skills and career strategies** from experienced researchers and professionals
- **Increase students' confidence** to succeed in their graduate programs
- Connect students with a **network of peers** to in turn increase their sense of social connectedness in the field
- **Mentor students** through group discussions and one-on-one sessions, providing guidance and encouragement necessary for success
- Provide a welcoming and inclusive **environment** conducive to relationship building and positive mindsets

Number of participants: 2019: 158; 2020: 201; 2021: 53



CRA-WP

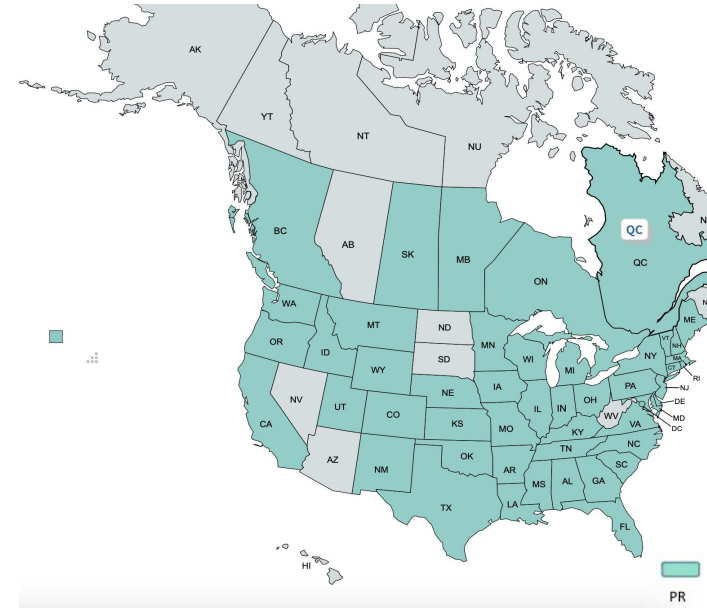
Computing Research Association
Widening Participation

Grad Cohort Workshop for Women

Goals:

- Provide **strategies** for navigating graduate school
- **Tips** on joining the CSE community
- Early **insights into career paths** and qualifications
- **Networking and mentoring** with successful senior researchers
- **Peer networking** and mentoring

Number of participants: 2019: 396; 2020: ; 2021: 426



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Widening Participation

Career Mentoring Workshop

Goals:

- **Increase representation** in Computer Science and Engineering faculty members and researchers/ technologists who reach the top of their respective career tracks
- **Enable participants** to identify their individual career needs and goals and take **concrete steps toward success** in their career/promotion
- **Augment participants' knowledge** of effective career management strategies for their career stage -- including effective communication, having a mentor, and increasing visibility
- **Increase participants' confidence** in their potential for career success/promotion based on a realistic assessment of their accomplishments
- **Grow participants' leadership skills.**
- Help participants **build a network for mutual support**



CRA-WP

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Widening Participation

CSGRAD4US & mentoring program

Computer and Information Science and Engineering Graduate Fellowships



Complements the new NSF CISE CSGrad4US Fellowship Program

Goals:

- Increase the number of diverse, domestic graduate students pursuing research careers in the computing fields
- Guide students through the application process towards a successful PhD admission
- Mentor students through the first year in graduate school
- Provide insight into how to be successful in graduate school and research

TRENDS

CERP: Center for Evaluating the Research Pipeline

Mission: To increase diversity in the field of computing research through **evaluation** and **research**.

An extension of CERP's mission is to be a **resource for the computing community**.



CERP

Computing Research Association
Evaluation

Who are we?

(Very brief) History

- Established by CRA-W in 2012
- Comparison data for program evaluation
- Fully operational in 2013
- Expanded its scope and activities since then

CRA CERP Staff

- Burçin Tamer, Director
- Heather Wright, Associate Director
- Evelyn Yarzebinski, Senior Research Associate
- Kristi Kelly, Research Associate
- Taniya Ross-Dunmore, Research Assistant
- Roohia Meer, Program Assistant (starting Oct 26, 2021)



CERP

Computing Research Association
Evaluation

The takeaway

- CERP is another resource CRA provides to the community to support efforts to broaden participation and to keep an eye on the field at an individual level in general
- CERP's work assesses the effectiveness of programs by CRA-WP and other organizations
- Provides evidence based insights to improve existing programs and create new ones



CERP

Computing Research Association
Evaluation

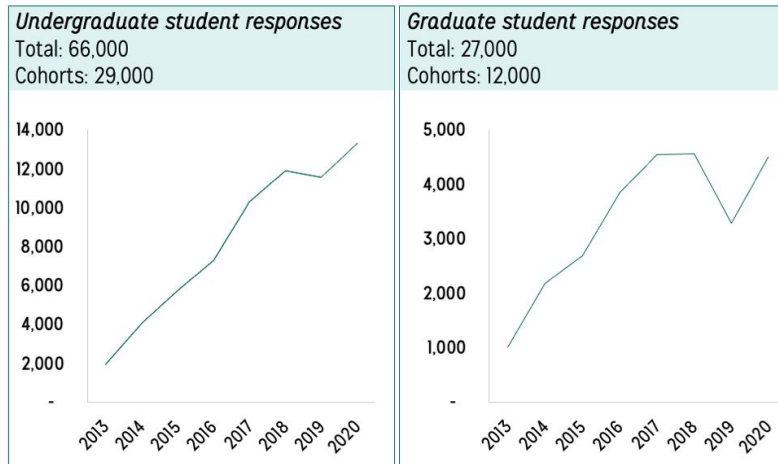
CERP Activities – Data Collection

- **The Data Buddies Project**
 - National level annual survey of undergraduate and graduate students since 2011
 - Today: Data from computing students, alumni, and professionals in higher education.
- **Departmental Policies and Data Practices Survey**
- **Program Evaluation Data**

Data Buddies Survey: 2013-2020

Number of responses: 93,000

Longitudinal cohorts: 41,000



Numbers are rounded up to the nearest thousand.

Source: Data Buddies Survey. Center for Evaluating the Research Pipeline, Computing Research Association.



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Evaluation

CERP Activities – Program Evaluation

- CERP evaluates programs at all levels of the postsecondary computing pipeline and at various scales
- More than 20 programs from CRA-WP, other BPC Alliances, and other organizations in computing
- NSF CISE REU Program evaluation

Types of evaluation:

- Program feedback
- Pre-post outcome evaluation
- Comparative evaluation



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CERP Activities – Knowledge Production and Community Engagement

Knowledge production

- CERP publishes monthly infographics in Computing Research News, presents research at conferences, and publishes work in proceedings and journals.

Community engagement

- Interacts with the community by providing resources and bringing stakeholders together for collaborative action

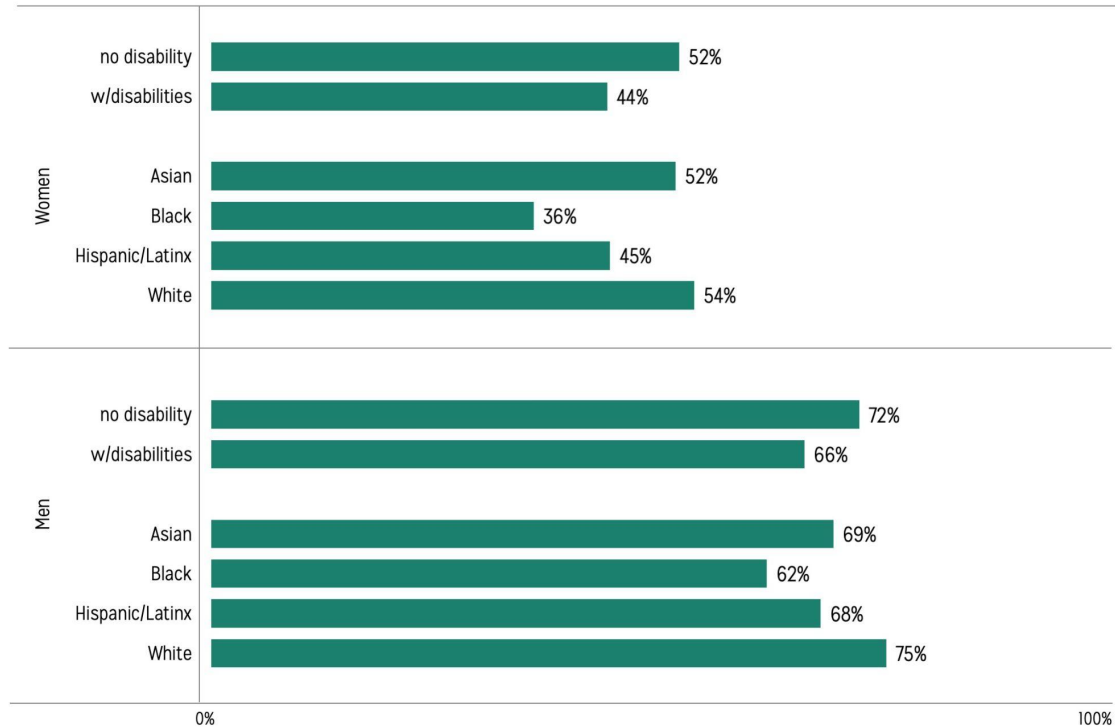


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Evaluation

Sense of Belonging

I feel welcome in computing



Source: Data Buddies Survey (DBS) 2018, Center for Evaluating the Research Pipeline, Computing Research Association
Sample sizes: Women (no disability = 2,402; w/disabilities = 253; Asian = 1,153; Black = 112; Hispanic/Latinx = 139; White = 1,006), Men (no disability = 4,278; w/disabilities = 387; Asian = 1,482; Black = 202; Hispanic/Latinx = 274; White = 2,252)

Populations who are underrepresented in computing feel significantly lower levels of sense of belonging

*Populations who are underrepresented:
Asian, Black,
Hispanic/Latinx
Women
Students with disabilities*

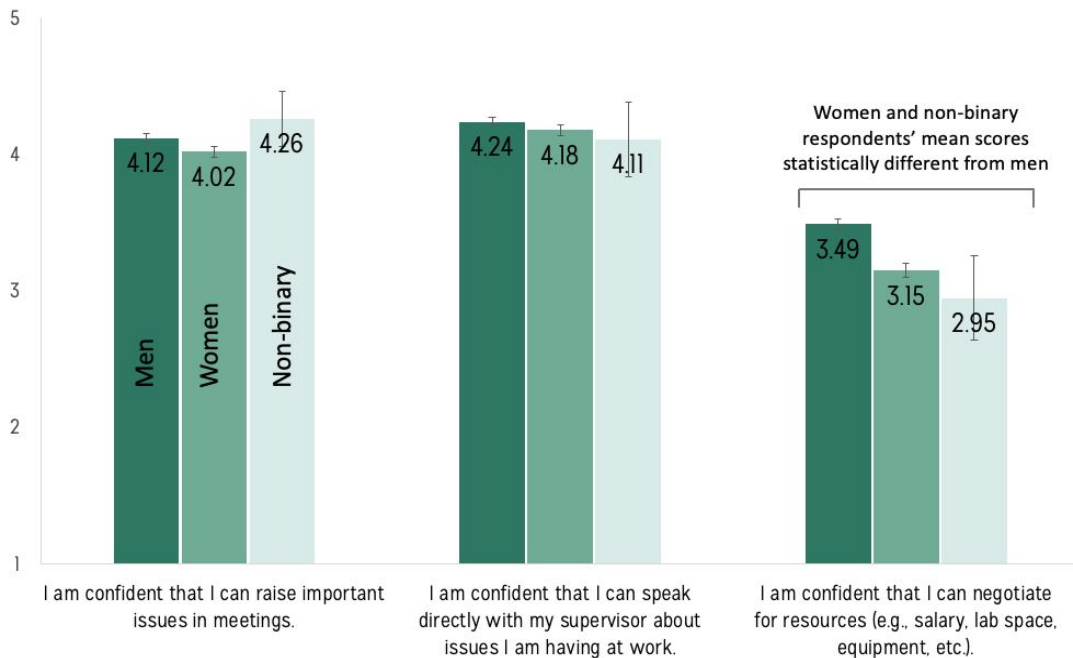


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Professional Self-Confidence

Computing professionals' level of confidence by gender identity



Women and Non-binary Gendered Computing Professionals Report Lower Confidence in Their Ability to Negotiate for Resources

Source: Data Buddies Survey (DBS) 2018, Center for Evaluating the Research Pipeline, Computing Research Association

Notes: Sample includes non-student professionals who were employed full-time or part-time in a computing-related job at the time of the survey. Graph displays mean values (scale from 1 "strongly disagree" to 5 "strongly agree") and 95% confidence intervals.

Sample sizes: Men ($n = 776$); Women ($n = 491$); Non-binary gender ($n = 19$).

Analysis by Heather Wright, 2020



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Career Mentoring Workshop: Immediate Impact

Compared to before the 2018 workshop, both early-career and mid-career participants were more likely to report a stronger vision for their current and future career trajectories after the 2018 workshop.

	Early-career		Mid-career	
	Before	After	Before	After
I have a long-range vision for my career.	3.62	3.76	2.61	3.17*
I know the steps I need to take to reach the next step in my career.	3.44	3.91*	2.83	3.56*
I know people I can go to for guidance on how to advance my career.	3.46	3.84*	3.06	3.83*

Note: Values represent mean scores for each individual item at Time 1 and Time 2. Responses were given on a five-point scale from (1) strongly disagree to (5) strongly agree. Statistically significant mean differences at the $p \leq .05$ level are indicated with emboldened text (*) in the Time 2 column.

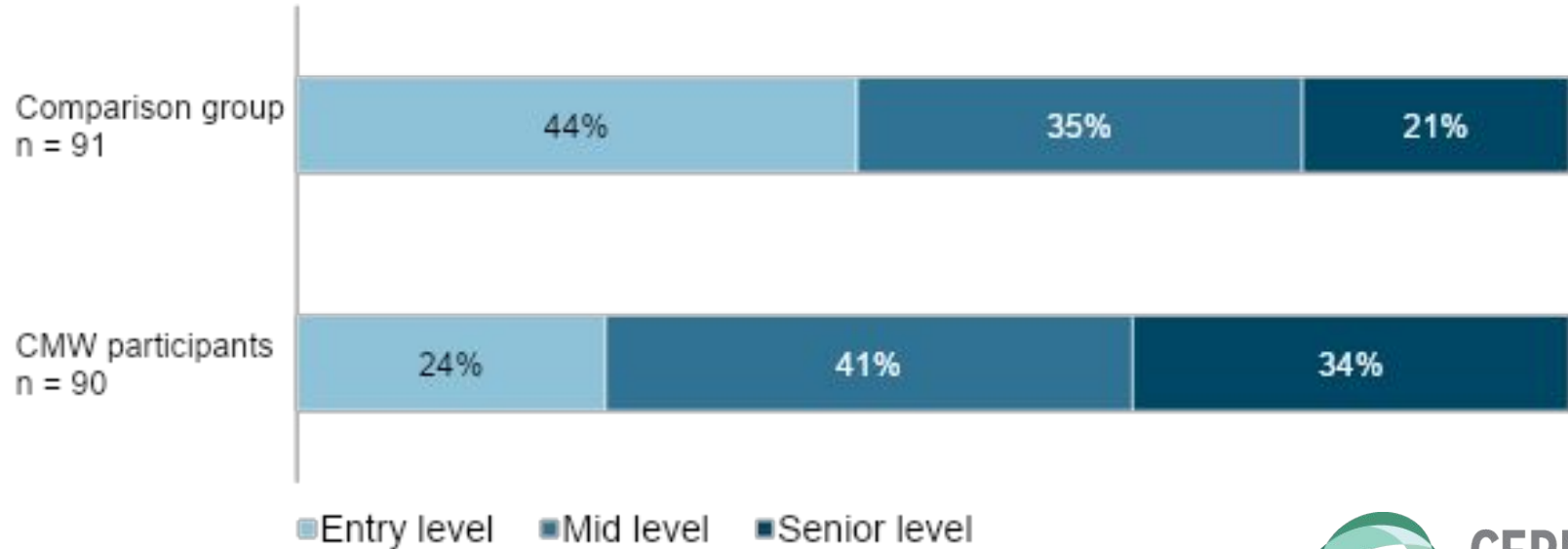


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Career Mentoring Workshops: Long Term Impact

Past CMW participants (2008 & 2009) were more likely to be further along in their careers than a random sample of women who received their PhD in computing around the same time as the participants.



Grad Cohort – IDEALS: Immediate Impact

Why do students want to attend Grad Cohort?

Top 3 reasons (Selected by more than 55% of participants):

- I wanted to learn **tips to succeed** in my degree program and future career
- I wanted to **meet mentors** who can help me in my future career
- I wanted to **meet peers** who are similar to me

Grad Cohort for Women: Immediate Impact

93%
participants satisfied
with networking
opportunities with
speakers/mentors

AFTER WORKSHOP, COMPARED TO BEFORE



- Computing identity
- Confidence
- Mentorship support
- Professional network
- Interest in computing career
- Interest in computing research career

AREAS WITH NO CHANGE OVER TIME

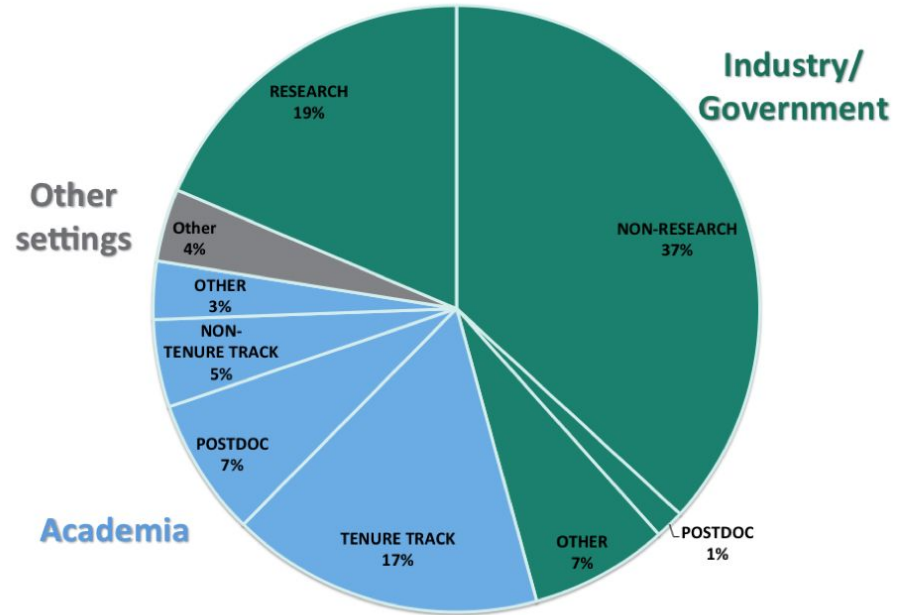


- Imposter syndrome
- Employment sector preference



Grad Cohort for Women: Long Term Impact

In 2015, CERP followed up with women who had attended a Grad Cohort for Women Workshop between 2004 and 2012. The majority of Grad Cohort women are employed in industry/government positions.



Analysis by Heather Wright, 2015



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Considerations

- We can see the trends in the field through Taulbee: There is clearly a need to take action
- Individual level data tells us where the problems lie and what the opportunities are
- CRA-WP programs are designed to take action to broaden participation in computing
 - Evidence based and systematically evaluated
- CERP supports efforts to broaden participation by being a resource through data collection, evaluation, research, and community engagement

Questions? Contact Us!

Computing Research Association

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