Department of Computer Science, I.K. Barber Faculty of Science, UBC Okanagan

Revising the Computer Science Major program to increase the participation of underrepresented groups

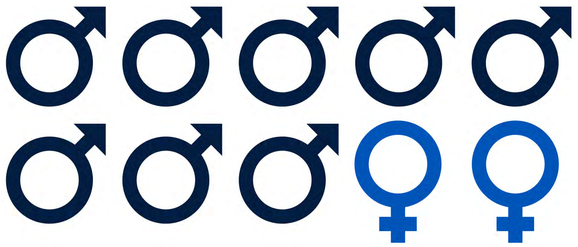
Patricia Lasserre, Bowen Hui, Ifeoma Adaji, Pourang Irani, Gema Rodríguez-Pérez, Corey Bond, Saira Furqan

Project Objective

Despite efforts to change the trends, stereotypes reinforced by media and movies as well as western culture continue to affect women's and other historically underrepresented groups' participation in computer science. Our objective is to revise our curriculum to highlight graduate outcomes, and focus on core learning outcomes and competencies, with an emphasis on removing barriers for historically underrepresented groups such as integrating diversity, equity, and inclusion strategies throughout the degree.

Current Enrolment Numbers

Enrolment gender distribution in the Computer Science program has been consistent since 2017 with 16-18% female students despite enrolment growth.



Data extracted from PAIR website with Computer Science as primary subject (Okanagan campus)

Seeking Student Input

A comprehensive 5-part study has been initiated to get feedback on the factors that affects students' perceptions of Computer Science:

- A survey of current UBCO students
- Focus group interviews with current UBCO students
- Focus group interviews with UBCO alumni
- Focus group interviews with industry professionals

Additionally, a survey of high school students is planned.

Factors contributing to the decline in female enrolment [1]

However, by the late-80s, enrollments began dropping – and disproportionately so for women [41]. The decline was "largely the result of explicit steps taken by academic institutions to reduce CS enrollments when it became impossible to hire sufficient faculty to meet the demand." [41] Steps included adding new GPA requirements for entering CS programmes, requiring more prerequisites, and retooling first-year CS as a weeder course [41]. These actions disproportionately hurt not only female participation in the field, but participation of racial minorities as well [41]. These "non-traditional" students had disproportionately come to CS via non-traditional paths (such as via psychology or linguistics) and disproportionately lacked the prerequisites as a result. The retooling of first-year CS as a weeder course also resulted in a competitive atmosphere that deterred many women. Once again we see *de facto* discrimination pushing women out of computing.

A warning against implementing obstacles to entry in CS programs [2]

of economic privilege). Thus the individuals experiencing the first course required for a computing major (CS1) in this way are more likely to be from less privileged geographies and from genders and races/ethnicities historically marginalized in tech. This is particularly true of students who applied to university to major in another discipline and now are interested in exploring CS+X. It is critical that their first experience in CS be one where they feel welcome."

Third, universities need to examine their processes for declaring a CS+X major. Booming enrollments in computing have caused many universities to cap CS majors [8, 40]. If there are substantial obstacles to entry into the major, such as a minimum GPA in CS1 and CS2, then students from populations historically marginalized in tech may be discouraged from considering a CS+X major.

The female student is a non active participant.

Computer Science programs that attempt to highlight women on their webpages

Included for illustrative purposes only

The female student listens to the male expert.

The female students are active participants.

Sources: https://cmps.ok.ubc.ca/undergraduate/computer-science/ ; https://www.sfu.ca/computing/prospective-students/undergraduate-students.html ; https://utsc.utoronto.ca/admissions/programs/computer-science

References

1. Elizabeth Patitsas, Michelle Craig, and Steve Easterbrook. 2014. A historical examination of the social factors affecting female participation in computing. In Proceedings of the 2014 conference on Innovation & technology in computer science education (ITiCSE '14). Association for Computing Machinery, New York, NY, USA, 111–116. https://doi.org/10.1145/2591708.2591731
2. Barr, V., Brodley, C. E., Gunter, E. L., Guzdial, M., Libeskind-Hadas, R., and Manaris, B. Cs+ x: Approaches, challenges, and opportunities in developing interdisciplinary computing curricula.[Pre-print from CS2023: ACM/IEEE-CS/AAAI Computer Science Curricula 2023]

Literature Review

A comprehensive literature review was completed with an EDI lens. The main findings were:

- − Students without programming experience are intimidated by students with experience.
- − There are measurable gender differences in perceptions of self-efficacy.
- \+ Communicating the availability of career paths with societal relevance helps encourage retention.
- \+ Mentorship programs are highly effective.

Program Learning Outcomes

Some examples of our drafted learning outcomes focused on EDI:

- Incorporate ethical considerations in CS processes, design, and user studies
- Recognize and take personal steps to remedy the current culture and diversity in the CS industry
- Critically evaluate societal impact of software design choices post deployment to address unintended harmful outcomes

Next Steps

- Complete surveys and focus groups.
- Revise the current first-year progression to better support EDI findings.
  - Focus on supporting both technical and creative pathways.
- Complete mapping of learning outcomes between course and program level.
- Use mapping to support course planning, including development of new electives.

Acknowledgement

We gratefully acknowledge the financial support for this project provided by UBC Okanagan students via the Aspire-2040 Learning Transformations Fund.