Supportive Practices for Computer Science

Supportive practices for computer science involve practices to recruit, retain, and provide a positive environment for **all** students who would take computer science courses, including and especially students that are traditionally seen as underrepresented groups in computer science. Underrepresented groups in computer science may not map with groups you would traditionally think of as underrepresented. While the suggested practices are deemed to be useful to underrepresented folks, they are actually good for nearly everyone

Think of a stereotypical computer science professional. What do they look like? The person you are thinking of is likely **not** part of a computer science underrepresented group. Underrepresented groups include *all* women of any race/ethnicity, African-Americans/Blacks, Hispanics, and Native Americans. They generally do not include white men and Asian men (including Indians).

Underrepresented groups are called that for a reason -- they are quite underrepresented in the field. The following table (Table 1) shows averages for technical staff self-reported by Apple, Facebook, Google, and Microsoft in 2018. The industry is only about 1/5th female, and percentages for African Americans/Blacks and Hispanics are at 5% or less. While Native Americans are not represented in the table shown below, they do not do any better.

	Female	White	Asian	Af-Am/Black	Hisp/Latinx
Industry	19%	51%	37%	5%	3%

Table 1: Demographics [2]

Here is a quick fact sheet diving into more depth on women's participation in computing "By the Numbers": https://www.ncwit.org/resources/numbers and here is a link to an article discussing the lack of Native Americans in the computing field: https://www.unm.edu/~varma/print/CACM_Native%20Americans.pdf

It is important for the field of computer science that the number of people in underrepresented groups increase. Computer scientists design the technology that all of humanity uses. Therefore, people from all groups should have a "seat at the table" to design technology that is applicable to all of humanity. Also, studies in business have often shown that **the more diverse a group, the better the ideas**.

Unfortunately, students from underrepresented groups are especially prone to negative interpretations of stereotypes (stereotype threat) to keep them away from computer science, as well as imposter syndrome. Stereotype threat occurs when students internalize a negative stereotype about themselves. Imposter syndrome can occur with any student (but especially

with underrepresented groups) and involves feelings that the student is an "imposter" and really doesn't belong.

Here is a link to more information on stereotype threat in computer science:
- https://www.ncwit.org/resources/stereotypes-and-stereotype-threat-affect-computing-students

Here are some links to more quick reading on imposter syndrome:
- https://en.wikipedia.org/wiki/Impostor_syndrome
- https://www.chicagotribune.com/2017/01/10/how-michelle-obama-helped-me-get-over-impostor-syndrome/

The purpose of supportive practices are to encourage all students to take computer science courses with the goal of making the field more equitable. Two frameworks of particular use in our class are the EngageCSEdu Engagement Practices and the Culturally Responsive Computing Practices.

The EngageCSEdu Engagement Practices [3] are described as "a framework of research-based teaching practices that support diversity." While the EngageCSEdu serves as a repository of faculty-contributed peer-reviewed materials for college-level CS1/CS2 courses [4], it also provides a framework of engagement practices that are much more general and applicable to a wide range of ages of students encountering introductory CS materials. These Engagement Practices are:
- Avoid Stereotypes
- Encourage Student Interaction
- Use Well-Structured Collaborative Learning
- Employ Meaningful and Relevant Content
- Make Interdisciplinary Connections to CS
- Address Misconceptions About the Field of CS
- Incorporate Student Choice
- Mitigate Stereotype Threat
- Give Effective Encouragement
- Provide Opportunities for Interactions with Faculty
- Offer Student-Centered Assessment

Here is a link to more information about the EngageCSEdu Engagement Practices:
https://www.engage-csedu.org/engagement/make-it-matter

As introductions to computer science trickle down to the high school level, these engagement practices and the homework/lab repositories are now applicable to high school programming classes.

In addition, Culturally Responsive Computing Practices [5] have also shown potential to encourage and support underrepresented student populations in computing. These tenets can be summarized as follows [1]:

- All students are capable of technical innovation.
- The learning context supports transformational use of technology — that is, students are encouraged to innovate and create for their own purposes not follow prescribed instructions or carry out educators' pre-conceived projects.
- Interest and ability in technical innovation is fostered when students examine connections between technology, computing, and their emerging identities.
- Connecting technology with community issues is vital for engaging diverse youth and transforming existing social conditions.
- Measures of program success should include assessment of critical literacies and account for who creates, for whom, and to what ends.

Here is a link to more information on Culturally Responsive Computing (CRC): https://ncwit.org/resource/how-can-you-engage-diverse-range-girls-computing/ (Note, while the name of the article has the term "girls", it does a good job of generally explaining CRC in the general context.)

Finally, there are many reasons to encourage students to take a computer science course. Encouragement from authority figures or people students respect can make a difference. The link below takes you to an internal slide deck showing a brief introduction to why computing is important, statistics, and career options to help you start thinking about talking points when encouraging students to take a computer science class. (The same information could also be useful when talking to parents/guardians about why computer science classes are useful.) Why should I take a computer science class? (Slide deck with notes)

Bibliography

[1] How Can You Engage a Diverse Range of Girls in Technology? | National Center for Women & Information Technology: 2016.

   https://ncwit.org/resource/how-can-you-engage-diverse-range-girls-computing/

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[2] Ibe, N.A., Howsmon, R., Penney, L., Granor, N., DeLyser, L.A. and Wang, K. 2018. Reflections of a Diversity, Equity, and Inclusion Working Group based on Data from a National CS Education Program. *Proceedings of the 49th ACM Technical Symposium on Computer Science Education* (2018), 711–716.

[3] Monge, A.E., Fadjo, C.L., Quinn, B.A. and Barker, L.J. 2015. EngageCSEdu: Engaging and Retaining CS1 and CS2 Students. *ACM Inroads*. 6, 1 (Feb. 2015), 6–11. DOI:https://doi.org/10.1145/2714569.

[4] Quinn, B.A. 2015. EngageCSEdu: A Living Collection of CS1 & CS2 Course Materials to Engage and Retain Diverse Students. *J. Comput. Sci. Coll.* 31, 2 (Dec. 2015), 155–157.

[5] Scott, K., Sheridan, K.M. and Clark, K. 2015. Culturally responsive computing. *Learning, Media and Technology*. 40, 4 (2015), 412–436.