acm Inroads
PAVING THE WAY TOWARD EXCELLENCE IN COMPUTING EDUCATION
2017 MARCH
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CONTENTS

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EDITORS' MESSAGE

NEWS

OPINION

ARTICLES

BACK PAGE

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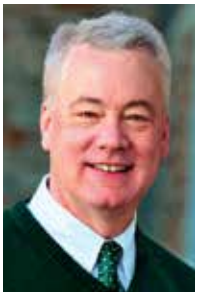

Mark Bailey
Hamilton College

Laurie Smith King
College of the Holy Cross

EDITORS' MESSAGE

Welcome to the March issue of *Inroads*. When this issue hits your local newsstand you might be packing your bags for your trip to Seattle to attend the SIGCSE Technical Symposium. If so, pack your umbrella and we'll see you there!

The *Inroads* Haiku contest has come to a close and we have some great submissions! Who knew geeks write good haiku? We thank you for all of your submissions. Back page editor John Barr will be pouring over the entries to select the best to appear in an upcoming issue.

We welcome Daniel Zingaro (University of Toronto, Mississauga) to the Editorial Advisory Board (EAB). Dan often presents at the SIGCSE Technical Symposium and has a couple of Nifty assignments to his name. Dan has also already authored two book reviews for *Inroads* (one appears in this issue) and we hope to see more contributions in the future. As we continue to expand our EAB, we welcome your nominations—including self-nominations.

Ellen Walker has been hard at work gathering news of a computing education bent from the ACM Special Interest Groups. This month we have reports from Amber Settle (SIGCSE) and Ginger Alford (SIGGRAPH Education Committee). We thank them for keeping us up-to-date across the computing education scene.

As always, our tireless columnists have been hard at work sharing their education insights. Regular columnist Gillian Bain has shifted her focus away from distance learning to start a new column entitled "Convergent Pathways in Tertiary Education." In this column, Gillian and co-author Graham Wilson, both of the University of the Highlands and Islands in the United Kingdom, write about educating a diverse student population of non-traditional CS students. We are excited to hear about these challenges and how we can bring their solutions to bear in our own classrooms.

We also welcome Beth Quinn from NCWIT. She proposed that *Inroads* highlight the EngageCSEdu project's efforts to attract a wider diversity of students to CS by fostering engaging introductory computing education, principally via a unique online repository of quality peer-reviewed materials informed by research on engaging and retaining students. Beth will curate a column, aptly named EngageCSEdu, that will present the excellent work of faculty making their introductory CS courses relevant and meaningful by integrating interdisciplinary content that helps attract and retain students. In this first column, Beth introduces the column and why its presence is important in *Inroads*. Welcome aboard Beth!

Finally, we'd like to introduce the new Technology that Educators of Computing Hail (TECH) column. (The first of these actually appeared in the last issue.) This column, organized by Dan Garcia (University of California, Berkeley), features a guest columnist each issue. These authors all presented work at a SIGCSE Symposium TECH session. TECH will highlight technologies that educators find useful in their classrooms. These pieces will focus on the technologies and how they are used, but are not comprehensive reviews of the systems. We hope you find a gem or two in these columns that you can apply in your classrooms. Thank you, Dan, for getting this project on its feet.

Each issue of *Inroads* only comes together because of the hard work of a large team of volunteers: Associate Editors, Columnists, News Contributors, Editorial Advisory Board members, authors, and reviewers. This group needs to represent the breadth of the computing education community. Please consider nominating someone you think would add a new perspective to the Inroads team. Also, consider signing up to be a reviewer. To do so, visit https://mc.manuscriptcentral.com/inroads. ❖

Mark Bailey and Laurie Smith King
Editors-in-Chief

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by Beth A. Quinn, Stephanie Weber, Terry Morreale, and Aaron Vimont, *National Center for Women & Information Technology*

Broadening Participation by Supporting Great Teaching

I walked into that 300-person lecture and never looked back. It was Intro to Programming. I had never even seen code before in my life. But I knew this class was going to be different. The professor made the environment comfortable and open enough for me to feel unafraid as a novice. For the first time in a long time I was engaged and interested in what I was learning. With programming, I love seeing my work 'come to life.' —Yadira, *new CS graduate*

Yadira is the first in her family to attend college. When she presented her story last fall to the Board of the National Center for Women & Information Technology (NCWIT), her eyes lit up as she described her experience in that first computer science class. It was "engaging" and "relevant to my life." This positive experience connected her to computer science, and this year she will graduate with a BS in Computer Science from a leading research university. A great experience in CS1 changed Yadira's life, and it illustrates the power of introductory classes to engage students in computing—or to turn them off.

Our mission at NCWIT is to increase the meaningful participation of girls and women in computing. Before NCWIT, programs focusing on women and computing existed mostly in isolation, without the benefit of shared best practices, effective resources, communication with others, or national reach. Today, these programs are part of the NCWIT community, where a "change leader network" of both men and women access evidence-based tools and resources and participate in an action-oriented national community of events and projects.

We developed EngageCSEdu, in collaboration with Google and a team of CS faculty and diversity experts, because one important way to broaden participation in computing is to ensure that all students have the opportunity for an engaging and welcoming experience in their introductory CS courses [5].[1] Just like Yadira.

Because of its specific focus on broadening participation, EngageCSEdu is a unique collection. First, all materials submitted to the collection undergo peer-review both by computer science educators and by learning and social scientists. Second, each material must use at least one "Engagement Practice"—a research-based technique to engage and motivate all students by "making it matter," "growing inclusive student community," or "building student confidence and professional identity." [7] Lastly, it's a big collection—more than 1,200 items—that's also easy to search. You can filter results on several criteria, including programming language and the Engagement Practice used. We're in the process of adding syllabi to the collection so you can explore how other instructors are sequencing their introductory courses. Chris Stephenson, Computer Science Education Program Manager at Google and former Executive Director of CSTA, sums up EngageCSEdu well: "Many faculty want to improve the engagement of diverse students in computer science undergraduate education. EngageCSEdu is a valuable peer-driven resource that helps achieve this goal."

Many faculty want to improve the engagement of diverse students in computer science undergraduate education. EngageCSEdu is a valuable peer-driven resource that helps achieve this goal.

Yadira's Intro Experience

In the quote that introduced this article, Yadira remarks that her intro CS professor "made the environment comfortable and open enough" for her to "feel unafraid as a novice." While we don't know what this specific professor did, we can offer some general research-based practices that you can use to the same effect. How can you help students feel comfortable being novices? How can you make a classroom feel "comfortable" and "open?" In this brief article, we highlight the Engagement Practices outlined in the *EngageCSEdu Engagement*

[1] For more information on how EngageCSEdu fits within NCWIT's larger strategic change model, see [12]. To learn more about the early development of EngageCSEdu, see [10].

Practices Framework that focus on growing "inclusive student community." As any experienced instructor knows, the students make the class—and the environment—as much as the professor does. So, fostering an inclusive student community is an important step in broadening participation in computing, and is one of three principles that make up the Engagement Practices Framework, the conceptual backbone of the EngageCSEdu project.[2]

Growing Inclusive Student Community

Students are more likely to persist when they have a community related to their academic pursuits [9]. One way that some departments attempt to create community for women students is by creating women's groups. While these are great first steps, it's not what we mean here. Instead, we are talking about the overall student culture, and whether women feel welcome both inside and outside of class. Faculty can help establish, support, and grow inclusive student community by following some relatively simple practices in the classroom, and by providing leadership and support outside of class time.

One way to do this in your classroom is by employing a well-structured **collaborative learning** technique such as peer instruction or Process Oriented Guided Inquiry Learning (POGIL) [3]. In addition to being excellent ways for students to learn, these practices help students get to know one another in the context of "work," form social networks for studying and for support, and practice working in teams. Learn more about collaborative learning on the EngageCSEdu site, where you will find collection materials that use these techniques, and links to background research and other sites with more detail [3,7,11].

While there is a lot of great information available on these techniques, there are some details to consider to be as inclusive as possible. For example, avoid divide-and-conquer task allocation where students may use stereotypes to assign tasks, e.g., having women do project management tasks rather than key technical ones [2]. Communicate that the goal is for all students to grow their skills. Also, avoid evoking stereotype threats by using women as an example or calling them out specifically. Just set the ground rules and apply them to everyone. To learn more, check out the Collaborative Learning page on the EngageCSEdu site [6].

The growth of an inclusive student community can also be encouraged through informal activities both in and out of the classroom or lab. **Informal activities** differ from collaborative learning experiences because the primary goal is to help students make social connections rather than to directly impact learning. While not "educational" per se, these activities—which we call "Student Interaction" in EngageCSEdu—can encourage the growth of important peer-support networks and a student-centered learning community. These can be as simple as an ice-breaking exercise early in the class. Like collaborative learning, not all ice-breakers will grow inclusive student community. There are some tricks to it. For example, avoid activities that might reinforce divisions between students based on gender, race, class, or other divisions where some groups are subject to negative stereotypes. Instead, find ways for students to find commonalities across the usual divisions. Also, set ground rules upfront and hold everyone accountable for them. These should include explicit instructions on "professional behavior," i.e., treating people like respected colleagues. To learn more about growing inclusive student community through informal activities, see the EngageCSEdu page on this Engagement Practice [8].

A final note on helping grow an inclusive, positive student community—computing has come to be associated with some strong stereotypes about who is a "computer scientist," or more narrowly, a "programmer." ("Brogrammer," anyone?) Students who don't fit the stereotype may have difficulty seeing themselves in the field and be less likely to have people supporting them in their pursuit of computing [1]. But faculty can help counteract these stereotypes, and the culture they promote, by modeling inclusive behavior and by teaching the norms of professionalism.

These are just some of the practices that you can use to grow inclusive student community. Check out the EngageCSEdu website to explore the other parts of the Engagement Practices Framework and to explore the peer-reviewed collection of materials for introductory computer science.

Figure 1: EngageCSEdu Screenshot: EngageCSEdu Engagement Principles

Calls for New Submissions

The EngageCSEdu collection has many great resources for collaborative learning and we're always looking for more. But we would also like to see submission of materials that instructors are using to *structure and implement* these activities. These could be student-facing materials on how pair programming works (including the basic ground rules) or short papers providing other instructors with tips on how to effectively offer a collaborative learning experience.

In addition to innovative materials on collaborative learning, we are looking for submissions focused on encouraging informal student interaction. Because of our his-

[2] The other principles are "Build Student Confidence and Professional Identity" and "Make it Matter." Explore these principles and the related practices on the EngageCSEdu platform [7]. Read about its genesis in previous *ACM Inroads* articles [4,10].

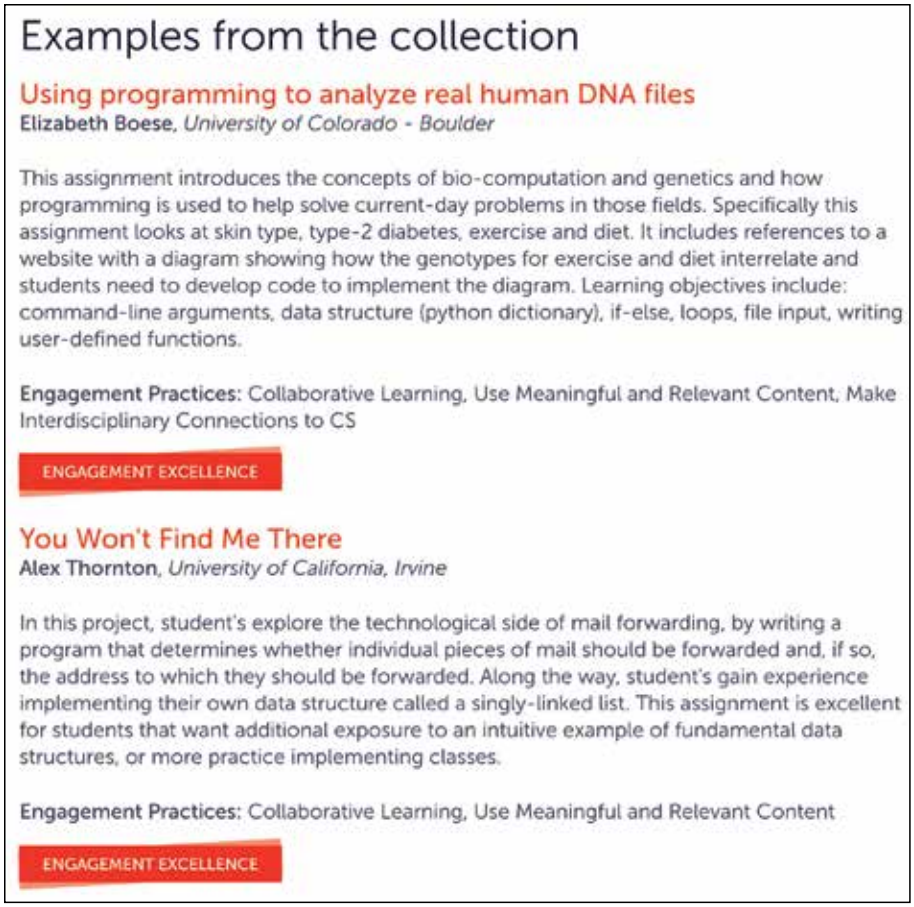

Figure 2: Exemplars from the Collection using Collaborative Learning

torical focus on student-facing materials, we have very few materials in the collection that provide the level of detail instructors need to effectively encourage informal student interaction. What fun activities do you do with your students in the first day or week to get them talking to each other in class? Do you have any techniques for encouraging students to work together outside of class? Do you have resources for setting ground rules for behavior in labs that have been particularly effective? If you do, please consider submitting them for consideration.

To submit for either of these calls, email us a brief description of your idea at engagecsedu@ncwit.org. We will work with you to find the right way to structure your materials for submission to our review process.

We'll be at SIGCSE in Seattle!

Come see us on the exhibitor floor at the 2017 meeting of the Special Interest Group on Computer Science Education (SIGCSE) March 8th through the 11th [13]! Look for the orange, blue, and green EngageCSEdu logo. We'll be available to talk about Engagement Practices, to discuss how you can submit your own course materials, and to sign you up to review. You can also pick up an Engagement Practices Framework poster, promo cards, and other EngageCSEdu materials while you're there. Please feel free to reach out to us at any time at engagecsedu@ncwit.org. ❖

Figure 3: EngageCSEdu logo

References

1. Ashcraft, K. Plenary I-The Glass Slipper: Leaning in...to the Evidence on Gender and Professions. *NCWIT Summit* (May 2015); https://www.ncwit.org/summit/archive/2015-ncwit-summit-plenary-i-glass-slipper-leaning-%E2%80%A6-evidence-gender-and-professions. Accessed 2016 December 12.
2. Barker, L.J. When do group projects widen the student experience gap? in *Innovation and Technology in Computer Science Education*. (Caparica, Portugal: ACM, 2005), 276–280.
3. CS-POGIL; http://cspogil.org/Home. Accessed 2016 December 10.
4. DuBow, W.M., Quinn, B.A., Townsend, G.C., Robinson, R., and Barr, V. Efforts to Make Computer Science More Inclusive of Women. *ACM Inroads*, 7, 4 (2016), 64–80.
5. EngageCSEdu; https://www.engage-csedu.org/. Accessed 2016 November 1.
6. EngageCSEdu, Collaborative Learning; https://www.engage-csedu.org/engagement/grow-positive-student-community/collaborative-learning. Accessed 2016 November 1.
7. EngageCSEdu, Engagement Practices Framework; https://www.engage-csedu.org/engagement/. Accessed 2016 November 1.
8. EngageCSEdu, Student Interaction; https://www.engage-csedu.org/engagement/grow-inclusive-student-community/encourage-student-interaction. Accessed 2016 November 1.
9. Joo, M., Nanette, K. and Tamara, V. Belonging and Academic Engagement Among Undergraduate STEM Students: A Multi-Institutional Study. *Research in Higher Education* (2015), 750–776.
10. Monge, A.E., Fadjo, C.L., Quinn, B.A., and Barker, L.J. EngageCSEdu: engaging and retaining CS1 and CS2 students. *ACM Inroads*, 6, 1 (2015), 6–11.
11. Peer Instruction in Computer Science; http://www.danielzingaro.com/pics.php Accessed 2016 December 16.
12. Recruit and Retain Strategically, NCWIT; https://www.ncwit.org/recruit-and-retain-strategically. Accessed 2016 December 21.
13. SIGCSE2017; http://sigcse2017.sigcse.org/ Accessed 2016 December 16.

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