

Conversations with a Prominent Propagator: Joanna Goode

David P. Bunde
Zack Butler
Christopher L. Hovey
Cynthia Taylor

Encouraging faculty to adopt new, high-impact teaching practices, tools, and curriculum in computer science (CS) undergraduate education requires intentional planning and sustained effort. This article is the next installment in the series of interviews with prominent propagators: members of the CS education community who have successfully spread pedagogical or curricular innovations [1–3]. The goal is to capture knowledge and experiences that others can use to propagate their own teaching projects.

In this article, we interviewed Joanna Goode, the Sommerville Knight Professor and Department Head in the College of Education at the University of Oregon. Joanna co-authored *Stuck in the Shallow End: Education, Race, and Computing*, which explores inequality in K-12 computer science education in the Los Angeles Unified School District [11]. This line of research led her to develop and propagate the Exploring Computer Science (ECS) high school curriculum. This project has prepared over 4,000 teachers in its professional development program and an estimated 100,000 students take ECS courses each year. Joanna’s line of scholarship examines how educational policies and practices can foster equity, access, and inclusion in K-12 computer science education [5–10, 12].

Below are highlights of the interview, which ran approximately an hour. The transcript has been edited for clarity and style.

Q: What motivated you to create Exploring Computer Science?

JG: It's been 15 years since we first began designing the Exploring Computer Science (ECS) program. The origin story of ECS fell out of *Stuck in the Shallow End*. Jane Margolis and I were part of a research team that had spent a lot of time in Los Angeles schools. We outlined ways that we saw the curricular materials being all teacher-developed because there were no common instructional materials to draw from, along with many teachers being the only CS teacher at their school. We saw the way that students were tracked into either AP courses or really low levels without any accessible, welcoming introductory course available.

The part of me that was a former computer science high school teacher thought, “Certainly there's something practical we can do about this.” As an education researcher, part of our diligence is to really understand the problem and take a critical disposition to why things are the way they are—in our case, why were there so few students of color and other girls in computer science high school classes? And I felt a sort of responsibility, thinking, “Well, now that we have some of these answers, what are we gonna do about it? Move to the next study and point out those problems?”

Being a former computer science teacher also allowed me to have some insights about what a new approach might look like, which would align with some of the approaches I had seen in Mathematics Education: inquiry-based, equity-focused, student-centered learning, spiraling concepts, connecting to issues and cultures that students identified with. Beginning in 2008 at SIGCSE, we pulled together a

group of folks who were thinking about Computer Science Education at the K-12 level. At that point, we fit around a very small table outside of one of the meeting rooms and it was a significant moment. The conversation was about picking a few key concepts of Computer Science: what is reasonable for teenagers in a daily 50-minute class, and which topics would hook students into this field? From there, we built out the ECS curriculum, involving a group of teachers who helped contribute particular lessons within the inquiry-based model that we set out.

My dear colleague, Gail Chapman, and I then took those lessons and created a year-long, six-unit curriculum with daily instructional guides for teachers. As teachers, both Gail and I knew that curriculum and instructional materials are really useful for people. However, they're sort of flat without teachers knowing how to make the materials come alive, or understand the intent or the pedagogy that best supports those particular lessons.

Q: How did you get teachers to adopt ECS materials?

JG: From the beginning, we created a professional development program that accompanies our instructional materials, and this has been the secret sauce. It's not the curriculum, it's this teacher learning experience and community that has been built using common instructional materials. It's a two-year program. We know from STEM education research that changing teachers' practice takes a significant amount of time. It takes a span of time for learning, reflecting, trying out, and repeating.

We have a five-day professional development institute over the summer, where teachers practice teaching lessons to each other. We have a 20-minute debrief of each lesson about the pedagogy, characteristics that really help highlight the material, and maybe moments where gender dynamics happened at a table for which teachers might step in. It raises the issues not in a judgmental way, but in a way that highlights the characteristics that support student learning, equity of engagement, and the joy of learning for students. We also discuss *Stuck in the Shallow End* a few times and talk about teachers' roles and responsibilities as Computer Science teachers, and as advocates at the school level for ensuring, for example, that their counselors are familiar with the kinds of students who are welcomed into Computer Science and ECS.

Q: How do you continue to support teachers throughout the year?

JG: One of the last things we do in those summer PDs is, "How do we keep in touch?" Typically that's where local communities are developed. There's also been tools like the CSforAll website [4] for online communities of practice. But what we've really noticed is that the people who the teachers are turning to are from the community that's built over the summer because they trust them. Having those relationships seems to be where people are most likely to reach out when it's, "Hey, how did you ...?" Or "Do you have a data set that can ...?" Those types of questions.

We also have four quarterly meetings over the year for those same teachers. As they are thinking about these topics and concepts, and they're doing it in their classroom, they have a place to come back, continue to learn, and discuss anything that comes up in their classrooms. Then they come back together the next summer and overlap with new-to-ECS teachers as a way to revisit and deepen their understanding of the lessons, experience additional pedagogy, and take on leadership roles.

This is where we can identify people who might become good local facilitators. We really think that helps grow the community: instead of having individual cohorts come through who don't have a lot of

cross pollination, we have these vibrant discussions. For instance, if people are expressing questions or hesitation around teaching the cornrow curves activity, there are other teachers in the room saying things like, “Don't worry, I taught it last year. Here are some of the strategies I used. And it ended up being one of the most important lessons of the year.”

Q: When teachers come back the second year, are they doing the same sorts of activities?

JG: Ninety percent are the same activities. We do one pullout where the second-year teachers do a mentoring reflection and think about how they will support the first-year ECS teachers. Sometimes it's, “Oh, I'm just doing the same thing again,” but a lot of our research has shown that this is where the growth around equity really deepens connections between understanding equity and inclusion hypothetically and what particular pedagogical maneuvers really help support those intentions. So it might be the same lesson, but they'll see it taught in a completely different way. There's a greater appreciation for the connections that you couldn't make before.

Q: How has ECS been adopted in different areas of the US?

JG: ECS has taken two different models. The first model is a hub model filled with lots of partnerships, which is used by the majority of ECS partners. For example, we began in the Los Angeles Unified School District by working with teachers and thinking about their professional development. Then we began partnering with the lovely people over at Chicago Public Schools, and they visited an early ECS Professional Development (PD) in Los Angeles. Since then, we've had dozens of partnerships from state levels like Alabama and Oregon, to territory levels like Puerto Rico, to other school district levels.

This model has allowed us to infuse the local leadership and those local communities as the conveners of the PD. For the first few years, we allocate our national ECS PD facilitators, who are a group of highly experienced ECS teachers. They get, say, Mississippi up and running, with the goal of having a local, sustained effort. This includes identifying second-year teachers, who enter an apprenticeship model to facilitate the third and fourth year of a program. Then the national facilitator exits. The local context helps with everything from recruitment to how teachers are compensated and which fund it comes from.

For about the past five or six years, we've also had a national ECS PD to capture rural people and other folks who might not have access to those hubs. That just requires principals signing on to say, “We will offer this course this upcoming school year.” We only want to do PD for teachers who are going to be reaching students. We want to make sure that we're keeping access open for teachers across the US.

One goal that we've never had is to go to scale for the sake of going to scale. It's always about building with quality and making sure we have teacher capacity and support, and institutional support so it's not all on the shoulders of teachers to keep the courses alive and ensure that sustainability is there as we grow.

Q: Is there a tension between letting people modify things and making sure they're not losing the important pieces?

JG: In the PD, we pull out a lesson and say, “Hey, you three teachers, you're in charge of Unit 2 Day 10. You're teaching this lesson and now you have planning time.” When they come back and deliver the

lesson later in the week, inevitably it has modifications. Sometimes it's shifted for the better and sometimes it ends up being a math teacher who's decided they want to put in slides of everything they know about math rather than let the kids just touch the paper bags and sort. That allows us to talk about those modifications: which ones stay true to the learning objectives of the lesson, and which modifications really highlight students' own voices or local cultures. It's allowing teachers to be professionals. Sometimes the conversation goes into what would you do differently in your own classroom, and why.

It's not a theoretical question. It is the bread and butter of what we're doing in those lessons. What does it actually mean to implement the course as designed? I think it's important to point out that the course is not designed as a script; a script can never be culturally responsive. Our curriculum is really about posing questions and organizing discussions. Those modifications are the hard work we're asking teachers to do every single day in their classrooms. We hope the professional development gives them that experience to be able to make those in-the-minute planning decisions based on who their students are and where they're teaching.

Q: Do you get pushback from teachers who insist on including “all the slides of math”?

JG: The beautiful thing about being in a teaching learning community is that we don't have to say anything, right? Collaboration gives places for us to do that reflection, and allows some of those teachers to hear their fellow teacher's reflections and experiences. Sometimes there is a realization moment of “I've always taught this way, nobody ever told me differently.” Some of those “a-ha!” moments come out of being in a learning environment that centers pedagogy over content knowledge, and also continuously comes back to themes of equity and inclusion and thinking, “Okay, did those slides help or hurt our goals around engaging all students in the classroom?” A lot of pushback becomes less pushback and starts getting absorbed and reflected because there's space for that. That's where the second summer is so nice, because they've gotten through some of that pushing back and are more open and looking for additional strategies to support pedagogy.

Q: What's next for ECS?

JG: We're in a co-design effort right now to have our version 10 of ECS be released next year. We're taking a justice-oriented approach thinking about big themes that we want to make sure we weave in. We're working with 12 teachers and really interrogating what kinds of pedagogy support a shift from “equity and computing topics” to “justice and computing topics” as a core tenet of the new curriculum. While equity rhetoric in CS education can be reductive and focus primarily on access or counting participation, taking a justice-focused approach allows us to consider how content and pedagogy can intentionally address social justice issues in computing. Our approach has taken on a dual focus: writing lessons that examine how systemic biases are engrained in the field of computer science and creating learning activities that leverage students' diverse identities as curricular assets. Maybe that's moving even further away from what some would consider math pedagogy, but I think it still has roots in the idea of allowing students to not only to solve big problems, but also to pose those problems and to consider the way that their communities are impacted by the very real applications of these concepts.

Q: Can you tell us a little bit about what that co-design process looks like?

JG: These folks from across the nation are not only ECS classroom teachers, they also facilitate these ECS workshops for us. We've been meeting monthly during the academic year to march through different

topics. We started off with colonialism and colonial logics, then moved to topics of race and racism, gender, sexuality, and intersectionality, class and capital, ableism and disability, and eco-justice. Teachers make connections and we have lots of notes on that. For example, when we talk about the computer buying process, we should also be talking about eco-justice and waste. It is gold what these teachers are thinking about and considering, and the ideas they have for weaving these really relevant societal issues not as a separate unit, but within the topics that are already being taught.

In the summer, most of those same folks join us in person, and we have some lesson writing development. The goal is to spend the next academic year putting it all together, with a new version of the curriculum to come out next spring. So it's a long process, but we want to do this authentically in ways that the teachers feel not only would fit in with instructional materials and would give a place to maneuver, because ECS is in schools everywhere from Florida to Oregon. Having a conversation about representing gender and how you do that is different in those professional development spaces. I feel like it's going to be a monumental shift for ECS to take broadening participation from access with a few equity-inclusive lessons to something that really infuses justice and equity throughout the entire design, really intentionally with the co-design efforts of teachers.

I'm also really excited to help connect how teachers are thinking about these issues and their intersectional identities and lived experience to how that impacts the student experience.

Q: What is the process of switching everyone over to using your new curriculum?

JG: That can be the challenging part. We let all of our partners know, and we use social media and a lot of teacher-to-teacher outreach. But beyond that, it's hard to do too much forced updating because it's a PDF. We've never regretted that because the system doesn't go down and we don't have a hundred teachers contacting us that they can't log on to a student activity, but that means that somebody might have the manual that we printed off at their Professional Development and that's what they use. We hope that people occasionally take a look and see if there's an update.

Q: What does success look like for you?

JG: That has certainly shifted over time. When we first started this effort, since CS had such little presence in schools, I used to think the goal was to include more folks and have their voices represented in a fairly narrow field.

My shift has been really appreciating the importance of foundational CS knowledge as a literacy. I find myself thinking that I can't identify a single student in any school who would not benefit from knowing a version of computing that is liberating, joyful, and helps them address the issues that they see around them in an empowering way that aligns with their interests and goals rather than just a career pathway. I think my vision of success is that every child will have those learning experiences that are welcoming and allow them to explore computing—to find the joy we know is in there but [computing] is not always presented in a way that allows kids to latch onto it. I remain convinced that teachers are the way of presenting that vision of Computer Science to students. So part of my vision is teachers being well prepared and having the resources they need in order to do the best for their students.

Q: What advice would you give to someone who is starting out propagating an innovation?

JG: Definitely form partnerships. None of this work has been done by individuals. A lot of these efforts are built on collaboration and relationships—and having a common vision of equity. Collaborative efforts are sustainable, and really encompass the multiple perspectives that we need to design things for people who bring in diverse experiences.

Q: What do you think is important for the future of broadening participation in CS?

JG: One of the places that I've been really reflecting on is the need to have more Black women, more Indigenous women, and more people with intersectional identities at the table as propagators doing this work. They already are at the table, but we need to shine additional light on their ideas and experiences.

I look back over the broadening participation in computing work and think: Are all the HBCUs [Historically Black Colleges and Universities] included in these efforts? Are Tribal Colleges included in these efforts? How are we making sure that as we talk about equity and justice, that it's not the same voices from the same colleges and universities leading these efforts, or only collaborating with each other? We need to expand our notions of the work, spotlight the folks who are coming to these projects, and ask different questions around who has benefited from efforts in broadening participation in computing. Even though I feel good about our progress in K-12, I wonder how much of the “for all” piece has just perpetuated gaps: everybody has gone up a little bit but we haven't really changed the proportion of people, particularly in intersectional identity groups. The future of my work is elevating the voices of people whose communities have not been served in efforts around computer science literacy and education.

Citations:

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David P. Bunde
Knox College
2 E. South St
Galesburg, Illinois 61401 USA
dbunde@knox.edu

Zack Butler
Rochester Institute of Technology
Rochester, NY 14623 USA
zjb@cs.rit.edu

Christopher L. Hovey
University of Colorado Boulder
1045 18th Street, UCB 315
Boulder, CO 80309
hoveyc@colorado.edu

Cynthia Taylor
Oberlin College
10 N Professor St
Oberlin OH, 44074
ctaylor@oberlin.edu