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## Conversation with a Prominent Propagator: Leo Porter

The CS education community has many good ideas about how to improve our teaching, but an often-overlooked piece is getting these innovations adopted by other instructors. Research has shown that pedagogical, curricular, and education technology changes are not readily adopted by instructors without deliberate planning and effort on the part of developers [11]. We believe that our community must embark on a sustained effort to learn more about evidence-based strategies for propagating educational innovations and to use them in our own projects. To support this goal, we have written a report summarizing current research on propagation [12], much of it from other STEM fields. We also hope to more fully capture the knowledge within the CS education community with a series of interviews of *prominent propagators*, i.e., people in the community who have successfully encouraged faculty to adopt an innovation that they created or one they themselves adopted.

In our first interview, we talked with Leo Porter, Associate Teaching Professor in the department of Computer Science and Engineering at UC San Diego. Leo is best known for his work as an earlier adopter, researcher and propagator of Peer Instruction [2,4,5,8,14], and other work on best practices in CS education [6,7,10,12,13]. Along with Beth Simon, Mark Guzdial, and Cynthia Lee, Leo developed the New Computer Science Faculty Teaching Workshop, aimed primarily at research-focused



Leo Porter

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faculty in their first three years of teaching. Participants in this workshop make explicit their teaching philosophies and explore how to incorporate active learning strategies into their teaching.

We asked Leo about the success of these workshops and his work to encourage broader use of Peer Instruction (PI). Below are highlights of the interview, which ran approximately an hour. After the interview, we communicated with Leo to seek clarification or to allow him to elaborate on certain items.

### Q: WHAT MOTIVATES YOU TO WORK ON ADOPTION/PROPAGATION?

**LP:** I think so many of our efforts fail to gain widespread adoption in computing because they simply fail to consider the challenges of gaining adoption. As a community, I would say that we don't benefit much from more one-off studies.<sup>1</sup> Instead, we want our research to actually change the field, and to do that, we need studies with replication and significant outreach to gain adoption. This means more work for researchers in our field, as there's a great deal of work involved in prioritizing adopt-

ability of the approach and planning for outreach. This includes planning replication studies and, in terms of adoption, factoring in potential adopters' needs, constraints, barriers to potential adoption, and motivations for adopting.

### Q: HOW DID YOU GET STARTED DOING PROPAGATION WORK?

**LP:** We were doing propagation from the very moment we had evidence that Peer Instruction appeared to be successful in CS. We were running outreach efforts in the form of one-to-one mentoring and hosting workshops. Admittedly, I suspect some of my early efforts may not have been as successful as they could have been because I didn't know the literature on faculty adoption.

I was naive enough to think we could just publish our findings and automatically gain adopters. Because of my background in computer architecture, I assumed research and adoption worked similarly across fields. If you are in architecture and you have the first idea that a cache optimization is way better than what's been done before, you publish that first idea and maybe a few follow-on studies. But if it's a substantial improvement, other researchers will likely pick

<sup>1</sup> Leo defined these as studies that are never replicated and without necessary follow-on work.

up the work to do follow-on studies and industry will be compelled to adopt it to be competitive and improve their products. I'd note that once it's been adopted by industry, the bar moves forward as this new improved version of the cache is now the baseline from which folks need to improve. But computing education is different from computer architecture and other areas of research. For education, if all we do is publish a study or two about an innovation without thinking about the adopters and fail to do any outreach, there's a very low chance our work will get adopted by teachers and as a result, the bar never changes. We run the risk of never moving the field forward.

**Q: WHAT MADE YOU DECIDE TO START DOING THE NEW FACULTY WORKSHOP?**

**LP:** I was invited to one of Charles Henderson's workshops fairly early on when he was developing a guide to use when writing NSF proposals [1]. So, I got an early look at the philosophy of that guide, which is that education innovators need to view adopters as users, just as we would users of a computer system or program. For example, if the user has to make a big change to their teaching, we have to provide a similarly large amount of support for them and provide them a big impetus for change. I think I failed to properly focus on the adopters in my earlier workshops on Peer Instruction.

After those early Peer Instruction workshops, we'd see some folks adopt Peer Instruction, but we'd also see many not make the shift and it wasn't really clear why some would make the change and others wouldn't. It was at that point we recognized the need to be making a bigger, concerted effort—both in coordinating the workshops to be adopter-centric but also by bringing together multiple best practices. As a key feature of these workshops, we realized we needed cohorts to support one another. And we learned a lot from the physics new faculty workshop and decided this model should exist for CS. It was when we started working on our NSF proposal that we realized these workshops for new faculty already existed for nearly every STEM field except computer science.

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**Q: WHAT'S BEEN THE HARDEST PART SO FAR?**

**LP:** The lack of feedback we receive years after the workshop and, separately, the problem of trying to build community. We're not alone in these problems as we've talked with our external evaluation team at Western Michigan, led by Charles Henderson and Andrea Beach, and learned that they struggled with similar issues with the physics workshop. For example, with our workshops, we'd build a system to help encourage communication with participants after the workshop ended. And then we'd only get a little participation. The first couple of years we seeded the system with questions; every week we'd do a post to try and get people to participate, but there was radio silence almost every time. Initially that was pretty upsetting for us, because this seemed to have no impact whatsoever. But we later realized that faculty are really busy people and just because they weren't replying, it didn't mean the workshop or messages weren't having an impact. In fact, we still run into prior participants at times and often learn they've adopted better teaching practices they learned about in our workshops.

**Q: ARE THERE OTHER CHALLENGES TO PEOPLE ADOPTING AN INNOVATION THAT YOU'VE ENCOUNTERED?**

**LP:** For Peer Instruction, I've seen folks adopt the pedagogy piecemeal or in some cases, intentionally or unintentionally, the practice mutates. For example, I might mentor one person and their approach to PI will be almost like mine.

Then they mentor someone else and within a few iterations, somebody would have dropped discussion and they'd have started grading on correctness instead of participation. It's almost like the telephone game in how the practice would get distorted. What was frustrating was that folks would use that distorted version, it wouldn't work well, and then they'd seem to decide that the innovation doesn't work without reflecting on how faithful their adoption was.

In fact, the number one change I hear from folks who adopted Peer Instruction without direct mentoring is that they elected to drop group discussion because "why should students hear from each other when they can hear from the expert?" Obviously, this is concerning for us as the adopter decided that the peer instruction part of Peer Instruction wasn't important! We've added materials to the Peer Instruction for CS website [3] to help give advice to new adopters, but it's unclear if that guidance gets to folks when they need it.

**Q: WHAT DO YOU DO TO GET BUY-IN FROM PARTICIPANTS AT THE NEW COMPUTER SCIENCE FACULTY TEACHING WORKSHOP?**

**LP:** The keynote at the Workshop is always led by someone who's well respected in the research community and the keynotes have almost always been a conversation with participants. Ed Lazowska's conversation asked what they want out of teaching, "Why are you in academia? What do you think your teaching could

## Conversation with a Prominent Propagator: Leo Porter

do for society?” Charles Isbell presented teaching as a moral imperative and that what we do has a profound impact on people’s lives so we need to be doing this well. This framing has been successful, in my opinion, at helping focus everyone on their teaching mission for the remainder of the workshop.

The next thing we do is an icebreaker session about different teaching perspectives. We have the participants take a teaching perspective inventory [9] before they arrive, and we group people by their perspectives. And then we discuss these perspectives as the context in which every other conversation happens. I think this session is instrumental because most of the arguments I hear about teaching are when someone takes one perspective, say a transmissionist perspective, and the person they are arguing with has another perspective, say a developmental perspective. Once you recognize the issue is the goals or perspective, it’s easier to point out this broader issue and make the discussion more productive.

### **Q: SOME DEPARTMENTS SEND MOST OR ALL OF THEIR NEW FACULTY TO THE WORKSHOP. HOW DID YOU ACHIEVE THIS LEVEL OF BUY-IN?**

**LP:** I think much of it is support from chairs. Very early on we reached out through the CRA to the chairs of departments and asked what they wanted out of the workshop. The general consensus was for more effective, more efficient teaching. Faculty have limited time and can’t spend too much time teaching. That gave us a mission for the workshop. Our messaging for the new faculty workshop is hence that it helps faculty enjoy teaching more, teach more effectively, and teach more efficiently.

The second piece is word-of-mouth. We’ve had groups attend in the past couple years who heard great things from prior attendees. We hope we continue to get participants from personal recommendations.

### **Q: ARE THERE THINGS THAT PREVENT BUY-IN?**

**LP:** One is that many institutions still struggle with how to evaluate teaching

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well. It seems most institutions are using student evaluations and people with good evaluations feel they can’t try anything new. They believe that if they try something new and it flops, their department’s going to hold that against them. The problem is, it could “flop” because the students didn’t like it as much but failure rates are halved and the students learn 5% more than they would have otherwise. That’s not a “flop” by most folks’ standards, but could be if all we use as a metric is student evaluations.

### **Q: FOR YOU, WHAT DOES SUCCESSFUL PROPAGATION LOOK LIKE?**

**LP:** I feel like one of the big moments for me was when I saw a group of PI adopters, folks we’d mentored or had at prior workshops, were running a Peer Instruction workshop at the SIGCSE symposium. I know those folks, and others, are running workshops regionally and at their home institutions as well. There was this great realization that they were now ambassadors for PI and were passing along all that they knew about PI to a new group of faculty. If it had stayed just the original four of us—Beth Simon, Dan Zingaro, Cynthia Lee, and me—PI wouldn’t have been able to spread as successfully.

I’ve also been in talks this past year where folks describe their courses and they mention in passing that they use Peer Instruction and move on. It means a lot to me as I suspect their students are learning more and the faculty member is likely enjoying teaching more. It’s also a sign that we’re moving our teaching baseline forward.

### **Q: WHAT ADVICE WOULD YOU GIVE TO SOMEONE INTERESTED IN PROPAGATING THEIR COOL IDEA?**

**LP:** I’d like to tell them two things. The first is that adopters should be in their mind when they first start a new project. Before diving in and spending months on a new course, new curriculum, or new tool, they should spend some time with their target audience and see what they want. Determine what their needs are and what barriers there would be for them to adopt your new idea. Only after bringing their views into your work should you proceed. But don’t forget to include those folks in discussions at various points. It’s worthwhile bluntly asking if some of those folks you talk with would be willing to adopt your new idea. You’ll get first adopters from the folks who say yes and you’ll get critically needed feedback about barriers to adoption from the folks who say no.

The second is that innovators need to see their first paper (or couple papers) as a starting point. Those first paper presentations should be aimed at their prospective adopters and they can use that presentation to get more feedback from the community. After that publication and presentation, there’s a lot of work to do to gain adopters and they should be prepared to do that work. ❖

## References

- Henderson, C., Cole, R., Froyd, J., Friedrichsen, D.G., Khatri, R. and Stanford, C. *Designing Educational Innovations for Sustained Adoption: A How-To Guide for Education Developers Who Want to Increase the Impact of Their Work*. (Kalamazoo, MI, Increase the Impact, 2015).
- Lee, C.B., Garcia, S. and Porter, L. Can peer instruction be effective in upper-division computer science courses? *ACM Transactions on Computing Education (TOCE)*, 13, 3 (ACM, New York, 2013), 12.
- Lee, C.B. and Simon, B. Peer Instruction for Computer Science, 2012; <http://peerinstruction4cs.com> Accessed 2019 November 26.
- Porter, L., Bailey Lee, C. and Simon, B. Halving fail rates using peer instruction: a study of four computer science courses. *Proceedings of the 44th ACM technical symposium on Computer science education* (2013), 177-182.
- Porter, L., Bailey Lee, C., Simon, B. and Zingaro, D. Peer instruction: do students really learn from peer discussion in computing? *Proceedings of the seventh international workshop on Computing education research* (2011), 45-52.
- Porter, L., Guzdial, M., McDowell, C. and Simon, B. Success in introductory programming: What works? *Communications of the ACM*, 56, 8 (2013), 34-36.
- Porter, L. and Simon, B. Retaining nearly one-third more majors with a trio of instructional best practices in CS1. *Proceeding of the 44th ACM technical symposium on Computer science education* (ACM, New York, 2013), 165-170.
- Porter, L., Zingaro, D. and Lister, R. 2014. Predicting student success using fine grain clicker data. *Proceedings of the tenth annual conference on International computing education research* (ACM, New York, 2014), 51-58.
- Pratt, D.D. and Collins, J.B. *TPI: Teaching Perspectives Inventory*. 2000; <http://www.teachingperspectives.com/tpi/>. Accessed 2019 November 26.
- Simon, B., Kinnunen, P., Porter, L. and Zazkis, D. Experience report: CS1 for majors with media computation. *Proceedings of the fifteenth annual conference on Innovation and technology in computer science education* (ACM, New York, 2010), 214-218.
- Stanford, C., Cole, R., Froyd, J., Henderson, C., Friedrichsen, D. and Khatri, R. Analysis of Propagation Plans in NSF-Funded Education Development Projects. *Journal of Science Education and Technology*, 26, 4 (Aug. 2017), 418-437. DOI:<https://doi.org/10.1007/s10956-017-9689-x>.
- Taylor, C., Spacco, J., Bunde, D.P., Butler, Z., Bort, H., Hovey, C.L., Maiorana, F. and Zeume, T. Propagating the Adoption of CS Educational Innovations. *ITICSE 2018 Companion: Proceedings Companion of the 23rd Annual ACM Conference on Innovation and Technology in Computer Science Education, July 2018* (ACM, New York, 2018), 217-235.
- Taylor, C., Zingaro, D., Porter, L., Webb, K.C., Lee, C.B. and Clancy, M. Computer science concept inventories: past and future. *Computer Science Education*, 24, 4 (2014), 253-276.
- Zingaro, D. and Porter, L. Peer Instruction in computing: The value of instructor intervention. *Computers & Education*, 71, (2014), 87-96.



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