

# Propagating Educational Innovations

Heather Bort  
Marquette University  
Milwaukee, WI, USA  
heather.bort@marquette.edu

David P. Bunde  
Knox College  
Galesburg, IL, USA  
dbunde@knox.edu

Zack Butler  
Rochester Inst. of Tech.  
Rochester, NY, USA  
zjb@cs.rit.edu

Christopher Lynnly Hovey  
University of Colorado Boulder  
Boulder, CO, USA  
hoveyc@colorado.edu

Cynthia Taylor  
Oberlin College  
Oberlin, OH, USA  
cynthia.taylor@oberlin.edu

## ABSTRACT

Many great teaching techniques are presented every year at SIGCSE and other CS education conferences. Unfortunately, most of them achieve very limited adoption, with few instructors incorporating these ideas into their classrooms. There is significant literature on how to encourage instructors to adopt educational innovations in other STEM fields, but the CS education community has made only limited strides in this area. This session will feature an interactive discussion of some of the barriers that prevent the adoption of good ideas, what solutions are available, and a brief presentation of the results of an ITiCSE working group on this topic. Attendees will leave the session better equipped to promote the adoption of educational innovations, either their own or ones that they have decided to champion.

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## 1 SUMMARY

To have significant impact in the community, an educational innovation (e.g. a tool, curriculum change, or pedagogical technique) must be adopted by many other instructors beyond its creator(s). Despite this, many people attempting to develop educational innovations, even those seeking external grant support, fail to adequately plan for recruiting and supporting adopters [2]. It is not enough to try to disseminate the innovation by publishing papers on its effectiveness; instead a significant effort must be devoted to its *propagation*, the process of actually increasing the number of instructors using it in their classrooms.

There is a substantial collection of literature on propagating educational innovations in STEM—particularly in physics education—but relatively little in CS specifically, and the CS education research community seems to have limited awareness of it. This led us (with

others) to participate in an ITiCSE working group that summarized existing literature on propagation in general, and its relation to CS higher education. We are proposing this special session to share our work in an interactive way and to initiate a community-level conversation on propagating educational innovations. We believe that this session will lay important groundwork for propagating the innovations presented each year in this conference, which will benefit the SIGCSE community and the computing higher education community in general.

## 2 OBJECTIVE

Our overall goal is to promote the idea that propagation requires specific planning. While we do not view this idea as controversial, our sense is that the community is generally unaware of the literature on promoting propagation, and that most of its members do not undertake such planning. Our goal is to change this situation.

After our session, attendees will be able to do the following:

- Identify individual, social, and institutional barriers that can prevent others from adopting educational innovations.
- Explain some strategies for overcoming those barriers.
- Find appropriate high-level resources from which to get more information, including our working group report and a short book on planning for propagation [1].

Given the limited time, we do not expect attendees to become propagation experts during the session. Rather, we see this time as the beginning of their exposure— they confront the fact that propagation is not automatic, talk about some of the issues, learn some of the high-level results, and gain resources for their own further study of the topic. To this end, we will provide them with a handout including best practices and pointers to further literature.

In addition to our goals for attendees, we plan to learn from members of the community about their perception of barriers to innovation and what would help them adopt. This is a check on the existing literature, most of which is from other STEM fields rather than CS specifically. In addition, the organizers plan to continue raising awareness of propagation planning after SIGCSE, so we are seeking feedback on the helpfulness of the work we have done so far and we hope to solicit ideas for future activities.

## 3 EXPECTATIONS

Our target audience is anyone with a current or future interest in promoting an educational innovation, either their own or one they have previously adopted. This includes everyone at SIGCSE.

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The session will cover what we consider to be the most important conclusions of our working group report. We are using an interactive style that asks attendees to explore the material based on their own experiences. This style fits our goals both by helping attendees learn the material and by implicitly pointing out possible differences between propagating educational innovations in CS and in other STEM fields, where most prior research was done. Incidentally, we will also be incorporating and modeling evidence-based teaching practices in leading the session, which will maximize participants' engagement and learning through our session.

## 4 SESSION OUTLINE

### 4.1 Introduction (8 minutes)

After introducing ourselves, we will give examples of innovations and define propagation. To motivate the session, we will present the highlights of a paper reporting that most NSF CCLI<sup>1</sup> proposals had no propagation plan and few had visible results [2]. We will also provide participants with an overview of the session.

### 4.2 Breakout sessions (57 minutes)

The bulk of the special session will be a series of scaffolded discussions in small groups, followed by “report outs,” large-group discussion, and a brief presentation by the organizers of the related literature. During the breakout time, session organizers will circulate around the room to encourage discussion. Session segments will be as follows:

- **Group formation (7 min).** Attendees organize into groups of 4–5 people and introduce themselves for 1–2 minutes each. In particular, we will have them mention educational innovations that they have tried to propagate, that they have adopted themselves, or that they considered but decided not to adopt. The rest of the conversation will be grounded in these experiences.
- **Motivating potential adopters (19 min).** Discussion of why attendees decided to try an innovation. What were their goals and how did they pick a particular innovation? (Where did they hear about it and what convinced them to try it?) Discussion within their group, followed by report out, whole-group discussion, and presentation on reasons given in surveys and the role of instructor identity. The goal is to show that instructors are not just rational evaluators of possible options and that some kinds of appeals are likely to be more effective than others.
- **Listing of challenges/obstacles to adoption (12 min).** Generation of a list of what prevents people from adopting. We will specifically prompt both for individual barriers (e.g. it uses a different programming language) and institutional barriers (e.g. needing to convince colleagues to change a course that is also taught by others or which is a prerequisite). Groups will come up with their own lists and then these are reported out so that all attendees can see them and use them for the next breakout.

<sup>1</sup>CCLI was an NSF program for educational innovation; it is a predecessor to the current IUSE program.

- **Addressing challenges/obstacles (19 min).** Next, groups will talk about strategies for addressing the challenges. These will be reported out, followed by a whole-group discussion of commonalities and themes. Then, the organizers will summarize relevant literature.

### 4.3 Summary (10 minutes)

The organizers will reiterate the need for specific planning for successful propagation, as well as presenting an overview of other topics from our working group report that were not covered in the session. We will make a specific point to introduce other materials in the literature, including giving out a handout with best practices for adoption and pointers to the literature. Any remaining time will be for general discussion.

## 5 PRESENTERS

All the presenters were members of a working group on propagating educational innovations at ITiCSE 2018. **Heather Bort** is a doctoral candidate at Marquette University and a member of the PUMP-CS project. Her work focuses on incorporating CS concepts within Humanities contexts for non-major courses. **David Bunde** is an Associate Professor at Knox College. He works to propagate techniques for parallel programming education and peer instruction, an active learning pedagogy. **Zack Butler** is a Professor at the Rochester Institute of Technology. He has studied the use of puzzles as a gender- and experience-neutral context for introductory CS courses. **Chris Hovey** is a social scientist in the Department of Information Science at the University of Colorado Boulder. His research focuses on what influences CS faculty to try out and routinely use innovative teaching practices, especially those that promote gender diversity and student retention, in undergraduate and graduate education. His most recent project surveyed over 800 instructors and professors across the U.S. about their adoption of innovative teaching in introductory CS courses. **Cynthia Taylor** is an Assistant Professor at Oberlin College who does research on active learning and assessment of student learning. She works to propagate peer instruction and concept inventories.

## 6 SUITABILITY FOR A SPECIAL SESSION

We believe a special session is the right way to present this material. It is not new research, but an important community conversation and a topic that CS education needs to learn from other fields. A panel would also be suitable except that potential panelists are not people who would typically attend SIGCSE, since they are outside CS education. A special session also allows the interactive style we propose here, which is particularly suited to our goals and which we hope will contribute to other conversations between SIGCSE attendees.

## REFERENCES

- [1] C. Henderson, R. Cole, J. Froyd, D. Friedrichsen, R. Khatri, and C. Stanford. 2015. *Designing Educational Innovations for Sustained Adoption: A How-To Guide for Education Developers Who Want to Increase the Impact of Their Work*. Increase the Impact, Kalamazoo, MI.
- [2] C. Stanford, R. Cole, J. Froyd, C. Henderson, D. Friedrichsen, and R. Khatri. 2017. Analysis of propagation plans in NSF-funded education development projects. *J. Sci. Educ. Technol.* 28 (2017), 418–437.