Five Days That Transformed My Teaching

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SUMMARY (129 words)
Exploring Computer Science (ECS) is a combination of curriculum [3] and professional development designed to be a broad introduction to CS for all high school students, with an emphasis on promoting equity in the classroom. The creators' primary objective was to create an engaging CS classroom that is attractive to all students and thus contains the same demographics among the students in the classroom as the surrounding neighborhood in terms of gender, ethnicity and socioeconomic status. The curriculum is based on years of research and its raison d'etre has been to democratize computer science education. Our participation in going through the professional development of ECS has fundamentally changed our philosophy and the way we teach our *college* courses, in particular with regard to *equity* and *guided inquiry* teaching practices. We will also talk about how the ECS curriculum and PD have been translated to Spanish and adapted for Puerto Rico.

Categories and Subject Descriptors
K.3.2 [Computers and Education] - Computer and Information Science Education
General Terms
Management, Human Factors
Keywords
Equity, Inquiry, Active Learning, Professional Development, Diversity

1. OVERALL SESSION OBJECTIVE
This special session has two objectives:

1. To help higher education CS instructors see the value of guided inquiry and equity in their classes and to provide practical suggestions on how to do it.
2. To provide an opportunity for instructors to reflect on specific teaching practices.

Computer science classes need to better incorporate a wide diversity of perspectives to address the shortfall in the number of students pursuing CS education and subsequent careers. To meet these goals, session leaders will provide an *experiential* session for attendees, by starting with an example of an Exploring Computer Science (ECS) lesson that could be used in a college classroom. Attendees will be prompted to reflect on how the example lesson addresses equity, and then will be asked to consider how to use this ECS approach in one of their own classes.

Who	What	Time
All	Brief Introduction	5
Patti	Participants outline a traditional CS lesson on how to teach sorting	5
Dale	Model an ECS lesson on sorting. Participants will take on the role of CS students during this lesson and interact with one another.	20
Helen	Break everyone into groups and reflect on "Who was able to participate in this lesson?" and "How do we know *which* students learned *what* about sorting?"	10
Joanna	Discuss ECS strands: Equity, Inquiry, Content.	5
All	Think / Pair / Share: Think about one of your classes, how could you "ECS it"?	15
All	How ECS has impacted us, and share out	15

Table 1: Session agenda with time in minutes (75 min. total)

2. MOTIVATION
According to the 2014 National Science Board's "Science and Engineering Indicators" report [4], the number of students in higher education in Science and Engineering has increased. However, the percentage of women and minorities in these fields has actually declined specifically in the fields of computer and mathematical sciences, physical sciences and engineering.
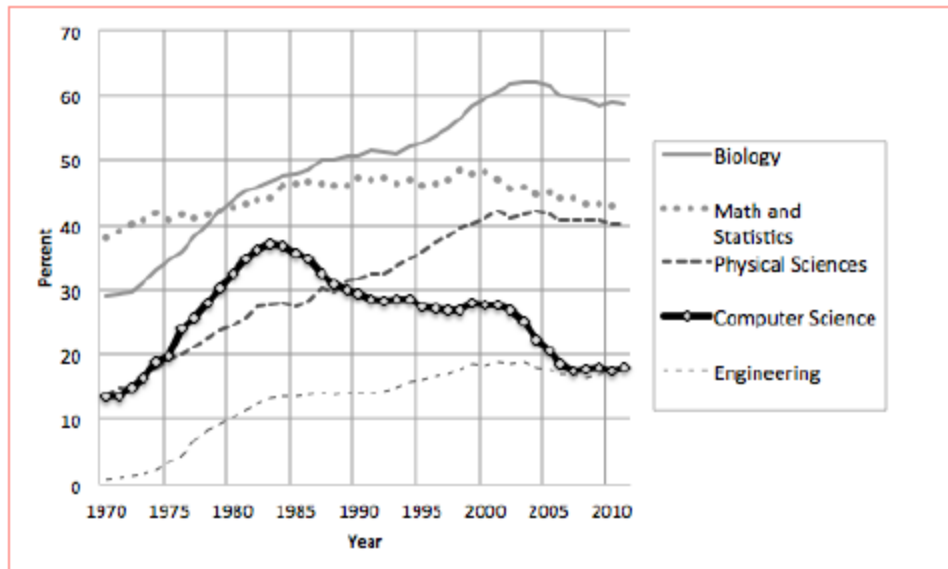
Figure 1: Percentage of Women earning Bachelor's degrees in STEM from 1970-2012 using data from [5]

CS (grouped together with Information Science (IS) in Figure 1) has a much worse problem attracting women than most other STEM disciplines. This prompted one expert to state that "we don't really have a STEM gender gap in the U.S., we have a TE [Technology and Engineering] gender gap!" [5] Disaggregating IS reveals the grim statistic that women earn only 12 percent of Bachelor's degrees in CS.

According to the US Bureau of Labor Statistics, 60 percent of all new STEM jobs in the next 10 years will be CS jobs, but only 2 percent of college students graduate with a CS degree [1]. Our nation's urgent need for more students to choose CS makes the issues of recruitment and retention of women and underrepresented students and the consideration of equity in the classroom more pressing. Pedagogical choices affect whether women and underrepresented students feel welcome in a CS classroom.

3. HOW ECS HAS TRANSFORMED OUR TEACHING

One session leader (Goode) is an author of the Exploring Computer Science (ECS) curriculum [2] and professional development workshop. Three of the session leaders are CS college instructors who attended an Exploring Computer Science professional development workshop and were surprised to discover the impact it had on their teaching.

3.1 Patti Ordóñez

I have been a teacher for most of my life in the roles of a high school teacher, a sports coach, a dance instructor, a teaching assistant or a university professor. I always seemed to do much better teaching salsa and field hockey than I did in the classroom because the classes were more active. At the ECS professional development workshop (PD) it become clear to me how I could turn my classroom into an active learning environment that was more inviting to ALL students. I was even more convinced when the learning at the PD on incorporating equity and inquiry-based instruction was *itself* taught by experiencing these techniques in the ECS classroom. The ECS PD transformed my approach to teaching.

3.2 Dale Reed

ECS has given me actionable insight into *how* to teach, in addition to what I already knew of *what* to teach. Having students individually reflect and then confer with another student next to them (Think-Pair-Share) is now an everyday staple of my classes. Journal writing is an important component to my courses and counts as part of students' grades. I rarely now ask "are there any questions" but rather have students check in with their elbow partner and then use raised number of fingers 1..5 ("Fist of Five") to check their level of understanding. These teaching practices have helped me make choices in my classes to inspire *all* students to learn and participate.

3.3 Helen Hu

Attending an ECS professional development workshop opened my eyes to the issue of equity in the computer science classroom. While I was long aware of the lack of diversity in my classrooms, it was not until the ECS workshop that I realized how pedagogy might impact equity. I now prefer to have students collaborate with other students before asking them for answers, which helps give confidence to the more reserved students in the class. Based on ECS's example, I've tried to incorporate more activities that are accessible to *every* student in the class and tried to provide better examples of applications that appeal to *all* students.

3.4 Joanna Goode

As a former high school computer science teacher and now as a professor of education, I'm keenly aware of how educational research has established the symbiotic connection between inquiry-based instruction, rigorous computing content, and culturally relevant pedagogy. Though ECS PD is designed to support the development of these pedagogical principles for K-12 ECS teachers, a wonderful unanticipated effect of this PD has been the pedagogical transformations of seasoned college educators.

4. EXPECTATION

This special session should appeal to anyone interested in incorporating more active learning with a focus on equity in their classrooms, although it will be most relevant to college instructors. Attendees will experience how students discover computer science for themselves in an ECS classroom. They will discuss how computer science lessons can be modified for equity and inquiry and will have the opportunity to consider how to "ECS" one of their own lessons.

5. SUITABILITY OF A SPECIAL SESSION

The best way to understand the value of the ECS pedagogy is to experience an ECS lesson, its debrief, and reflection, and a special session provides the needed time and flexibility, unlike other formats.

6. ACKNOWLEDGMENTS

7. REFERENCES

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