

One-Day Activities for K-12 Face-to-Face Outreach

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1. SUMMARY

The recent successes of Computer Science Education Week and code.org's *Hour of Code* have meant that more K-12 students than ever are being given an authentic, engaging and eye-opening exposure to the wonders of computer science. There are resources aplenty to help high school and college faculty with outreach. These range from easy-to-learn, open-ended programming environments (Scratch, Alice, Snap!), to online coding challenges (code.org, Lite-bot), to non-computer activities with live performances (CS Unplugged, cs4fn), to having the entire outreach experience delivered "in a box", thanks to NCWIT [1].

We wanted to bring educators together to share experiences with what they've done specifically *with a one-day event*, given these vast resources. Now that there are so many online coding experiences, it is enough to shuttle young students into a computer room, point their browser at one of these experiences, and answer questions as they come up? Is it important to include hands-on *and* hands-off (e.g., nifty demos, inspiring talks) components, and if so, in what order? What do different demographics find the most engaging? Is there any chance that we can do "damage", since these highlight-reel experiences might over-simplify how hard some of the problems are, and that not every important result

has a flashy payoff? Do some of the early experiences leave students with the impression that computer science is *only* (say) apps, interactive multimedia programs or solving mazes? Finally, when it's over, what follow-up is appropriate? Participants on the panel will share best practices, common pitfalls, and advice.

2. DANIEL D. GARCIA

The one-day outreach activities we have been involved with at UC Berkeley come in two flavors. The first, *Cal Day*, is UC Berkeley's open house day for newly accepted freshmen and their families. In addition to the normal tours of the robot lab and maker space and presentations about the CS major, we have a few activities we've run that many find particularly engaging. Younger visitors enjoy our *Scratch drop-in lab*, staffed by friendly undergrads and a faculty mentor. Nearby, we offer a *CS Unplugged* room where undergrads teach our three favorite activities every 30m. Our *Game Theory* and *Teaching Privacy* research groups holds open hands-on labs where visitors can learn about strongly solving board games and privacy in the social media age, respectively. Undergraduates also demonstrate projects that students create in upper-division classes. With close to a thousand visitors circulating through our building before the day is over, we endeavor to have activities that appeal to young and old, and the success is thanks to the many undergrad volunteers.

The second is our CS Education Day, where we bring 500 students from diverse-population local high schools to campus for a highly scripted, staff-intensive day to see the "best of the best" of our department. The students are split into two groups, one has its morning filled with inspiring talks and fun student-led demos, and its afternoon with three hands-on activities (*CS Unplugged*, a *Snap! Hour of Code*, and a Game Theory interactive session) and the other group is reversed. We ask parents to chaperone so that the ratio is 10 kids per adult, and it's an incredibly rewarding experience, also relying on student volunteers to make it run well.

3. WEI DING & JOSEPH COHEN

The annual one-day tech-savvy computing camp has been part of Boston's city-wide initiative since 2010 to increase the interest and participation of intermediate school students in science, technology, and scientific research. The team at the University of Massachusetts Boston aims to create an exciting curriculum for introducing CS in one day, focusing on interactive

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visual interface design and collaborative teamwork. The outcomes are to educate students on what computer science is, correct any misconceptions they may have, and allow them to have a sense of accomplishment to kick start their computer science career path.

The one-day event is split into algorithm design and software implementation. Computer science algorithms are introduced through group game activities, such as sorting and searching, without involving computers. We isolate algorithms from implementation in order to eliminate the stereotype that computer science entirely involves computers. Software implementation is taught using the *Throw* platform we specially designed for the event. It allows us to promote computer science as a people-oriented major by having collaborative coding where they learn to work on a team. We also have a competition for best creation using the platform by the end of the one-day event.

4. BARBARA ERICSON

The *Institute for Computing Education* at Georgia Tech has offered 3-4 hour workshops for students for years. We have been offering workshops for Girl Scouts since 2005. We also have offered fee-based computing workshops to 4th graders through 8th graders since 2010. We do pre- and post-attitude surveys to measure confidence, enjoyment, perceived usefulness, motivation to succeed, identity and belonging, gender equality, creativity in computing, and intent to persist. We have run workshops on Web Design, Scratch, Alice, LEGO robots (WeDo, NXT, and EV3), App inventor, and EarSketch. Many of these workshops have resulted in statistically significant positive changes in attitudes towards computing, but not all. Some workshops have had negative results where the students found the activities too challenging or boring.

We recommend working with your local Girl Scout council and other youth serving organizations like Black Girls Code in order to reach more girls. We also recommend advertising workshops to local teachers, local schools, and faculty. Hands-on workshops are best with 1 or 2 students per computer. Girls especially enjoy doing something creative and social. Make sure that projects are easy enough for all students to complete and also have challenges for advanced students. Start with partially-completed projects for younger students. We recommend always doing some open-ended project and having the students show off what they have created. Consider including parents in some workshops and give parents brochures from NCWIT or ACM about computing. Try to counter the stereotypes about computing, but don't mention the stereotypes. We found that talking about the stereotypes tended to result in negative changes in attitudes about computing. Connect what the students are doing to careers in computing. Use near-peer helpers to provide role models for the participants. We have shared our successful projects in Alice, Scratch, App Inventor, and LEGO EV3 robots online [2].

5. JEFF GRAY

The goal of our one-day events is to provide initial awareness of opportunities in computer science along with some surface-level example of an exciting topic in computing, often involving a brief programming and/or unplugged activity. When hosted on campus, the visit also provides a tour of different labs that highlight the breadth of computing. The diverse backgrounds of the students who attend our one-day workshops suggest that each workshop should be customized to the particular needs of each student group (either by age, gender, or type and size of their school). After an initial discussion on the opportunities in CS, the remainder of the one-day visit is adjusted based on the interests of

the students. They are given the option of several different hands-on activities (e.g., learning how to create an app in App Inventor, programming a robot in a small team) that can be explored during their visit.

We have found that one-day events can be a very fun time for both students and instructors, but need to be carefully planned – for many students, this is their first exposure to true computer science, so there is pressure to deliver a very memorable and informative experience. To facilitate the interaction with students who are visiting for a very short period of time, we have begun to develop a set of Blockly environments that demonstrate topics in computing (e.g., robotics with Spherly and media computation with Pixly) with languages that invite students to explore computer science using an inquiry-focused strategy.

6. DALE REED

UIC has provided CS evangelism in the form of presentations and short hands-on activities to over 10,000 high school students in the Chicago area since 2005. While the majority of these are 50-90 minute classroom visits during the school year, others have been Saturday Open House events using Blockly and LightBot and six-hour Saturday events focusing on Lego Robotics, Scratch with picoBoards or App Inventor. These events typically start with something magical or unexpected to focus the attention of the group, followed by 3-word introductions for everyone in the room (e.g. "I'm Dale Reed from UIC. My 3 words are Computers, Juggling, and Foldup-Bike). A collaborative environment is established as students are asked to work with a partner. When questions inevitably arise, teachers ask students to "ask three before me," as usually there are many more students than teachers/tutors. Activities are hands-on as early as possible.

We recommend that teachers communicate respect for what students already know, connecting the curriculum to it. Even when students don't initially know the technical content, they will quickly come up with interesting applications of the technology that we as teachers might never think of. A more lasting impact can be achieved by choosing some technological tool that students can subsequently continue to explore on their own (e.g. Snap!, Scratch, AppInventor) and which they will be motivated to show to their friends. In our experience, compelling direct-instruction is not as engaging as using guided inquiry with hands-on projects. While acknowledging that each location may be different, we recommend running the activities from 9am–3:30pm, including lunch and breaks. Friendly competition helps motivate interest but should only be used for parts of the event. In our experience the most bang-for-your-buck can be achieved by providing give-away prizes to less than 30% of the attendees. This increases the perceived value of each prize, like stuffed animals at a carnival that are desirable mostly because only a few people have them. It is helpful to end the session with a gallery walk where students can present their work to each other. A guiding philosophy has been to "Leave something in their head and in their hands" so students take away not only stimulating ideas but some concrete reminder of what they have done and learned.

7. REFERENCES

- [1] NC-WIT. *Outreach-in-a-Box: Discovering IT*. September, 2014. www.ncwit.org/resources/outreach-box-discovering-it
- [2] Georgia Tech. *ICE Distance Learning Site*. <http://ice-web.cc.gatech.edu/d1/>