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HCl education reflects the continual evolution of HCl, embracing the changing landscapes of technology, infrastructure, and technology use. This forum aims to provide a platform for HCl educators, practitioners, researchers, and students to share their perspectives, reflections, and experiences related to HCl education. — **Sukeshini Grandhi, Editor** 

# Human-Centered Design Charrettes for K–12 Outreach

#### Elena Agapie and Andrew Davidson, University of Washington

I was taught as a young child that you lift as you climb, meaning you pull someone with you and assist them...

— Layla Ibrahim, HCDE senior

he Human Centered Design and Engineering (HCDE) department at the University of Washington (UW) organizes a variety of K-12 outreach activities [1], including workshops for design thinking, user research, and prototyping. The outreach program raises awareness about the field of human-centered design for young learners. These activities are fastpaced, take a hands-on approach, and are customized for each group of student participants. In this article, we present an approach for introducing human-centered design to K–12 students by empowering undergraduate students to develop and teach these outreach workshops.

A large number of our undergraduate students elect to participate in our outreach program each year. We have worked with thousands of K–12 students in the state of Washington, in a variety of settings, urban, suburban, rural, and tribal, in diverse public and private schools. We have also participated in events organized on the UW campus by groups such as the College of Engineering (Engineering Discovery Days), Society for Women Engineers, Women in Science and Engineering (WiSE), and the National Society of Black Engineers.

To introduce K–12 students to the field of human-centered design

(and more generally to STEM disciplines), HCDE students develop and lead a workshop curriculum, the human-centered design *charrette*. In the charrette, K–12 students learn to design a website or a mobile application while keeping the users of the technology at the forefront of their thinking and making.

Here, we discuss how HCDE students take a human-centered approach to doing outreach. They design charrette workshops that fit the needs and interests of the target students by engaging teachers in *co-designing* the activities. We also discuss the different ways in which we adapt the workshop curriculum to the interests of the students who will get to experience it, as well as to their classroom setting. We describe how we scaffold educational experiences for service learning that empower undergraduate students to design and

#### Insights

- → Hands-on, human-centered design workshops are effective for outreach, helping motivate K-12 students to pursue STEM fields.
- → Empowering undergraduate students to lead charrettes in service-learning study opportunities allows them to serve as mentors and role models.
- → Co-designing workshops with K-12 teachers allows the customization of workshops to make them relevant and engaging.

teach these workshops and to serve as role models for the younger students.

## THE HUMAN-CENTERED DESIGN CHARRETTE

The charrette gives K–12 students hands-on experience with activities and methodologies commonly used in the human-centered design discipline. Students are given a design challenge, such as developing a citizenscience application. In one charrette conducted in a coastal town, they were asked to create an app that allows a person in their community to collect information that helps scientists learn something about a topic. Students brainstormed about potential users and chose one as a target client. In this case, students chose to design an app for local fishermen. They identified the fishermen's needs, which at the time were concerned with a declining salmon population. The students drew storyboards with the scenario describing how the fishermen would use the app: to help scientists track salmon-migration patterns and understand where the fish are (or aren't). They created interaction flows highlighting the structure of the app (Figure 1), sketched screen interfaces, and developed an interactive prototype of the app using the Marvel software tool (Figure 2). At the end of the workshop, the students demonstrated their prototypes for this salmontracking app. We found that design challenges such as citizen science are effective at creating engagement throughout the design process for students in both middle and high schools in a variety of courses.



Figure 1. An HCDE student provides feedback to middle school students on the interaction flow for the app they are designing during a charrette.

In each charrette, HCDE undergraduate students function as classroom teachers, conducting the workshop, presenting the material, and facilitating the activities of the K–12 student groups. In addition to guiding the students in the process, they also must exercise good classroommanagement practices for a workshop to be successful.

The charrettes are typically offered in classrooms with 20 to 30 students, with special events accommodating as many as 60 participants. We find that it is most effective to have students work in small groups (of usually three to four), having one undergraduate student facilitator for each four to 10 of the K–12 students. Middle school students generally need more coaching, so more undergraduates are deployed in those classrooms.

The workshops are planned to last between one and five hours. This provides opportunities for the K–12 students to interact closely with the college students. These interactions often lead to informal conversations between the two groups that are priceless. K–12 students frequently ask questions about college studies and life outside of academic pursuits. Having the opportunity to spend time with current undergraduates allows them to envision themselves as college students, which is often difficult for young people, especially in underserved communities.

We find these direct classroom interactions with current undergraduates to be far more effective in generating interest in humancentered design, engineering, and college in general than using traditional "booth and brochure" methods of outreach to K–12 students.

#### CO-DESIGNING THE CHARRETTE WITH TEACHERS TO FIT THE CLASSROOM SETTING

Our team takes a human-centered approach as we design a charrette. We identify the needs of the students and research their educational and community environments. HCDE undergraduates co-design the charrette workshops with the classroom teachers. They interview the teachers about student interests, learning goals, available time, room layout, students with special needs, and classroom technology. This allows us to customize the workshop.

Co-designing with teachers in an urban and rural setting. While we do many workshops locally, near the UW Seattle campus, we also try to reach schools that are outside of this urban area to fulfill our mandate as a public state university. Students in districts farther away from Seattle have a harder time learning about the UW and its myriad opportunities. To work with schools in distant communities, we collaborate with the UW Pipeline Project [2], which has been successfully bringing outreach workshops to remote locations in Washington for decades. In one such effort, we offered a weeklong workshop at Neah Bay High School and Markishtum Middle School, both in Neah Bay, Washington, in conjunction with Pipeline's Alternative Spring Break (ASB) initiative [3].

In Neah Bay, the charrette workshop took place in one-hour class sessions each day for one week, in middle and high school classes. Planning the curriculum for such a workshop began more than three months in advance. In a visit to the school in the autumn, program leaders met with the school's educational team to discuss workshop topics and

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structure. During a quarter-long seminar in winter, undergraduate students developed a new workshop from scratch and traveled to Neah Bay to conduct the charrette.

For charrettes offered locally in the Seattle area, the pre-planning is simplified and compressed, and the workshops are typically conducted during one or two days at multiple schools. Regardless of location or structure, all undergraduate student facilitators participate in the seminar to prepare for conducting the workshops.

Choosing the design challenge. The design challenge of our workshops is also developed based on teacher and student feedback from past workshops. The topic of the challenge can vary based on community interests. We choose design challenges that are of interest to a wide group of students and that give them flexibility to choose an activity that resonates with them, such as designing for groups of people who have similar interests (e.g., people who like sports, concerts) or people from their own community (e.g., parents, fishermen, police officers). In urban areas, we have posed challenges like designing smart cars, because transit is of high relevance to those students. However, in a rural area like Neah Bay, we found other topics, such as storytelling or

citizen science, to be of more interest.

One of the Neah Bay teachers reported that they appreciated the thought we put into understanding what is important to their community and choosing topics that were in line with their values. Neah Bay schools are public, associated with the Makah Tribe [4] community.

Adapting the charrette to different grade levels. We adapt the design activities based on the students' grade levels to make them easy to understand and engaging for every student. To help students work through the charrette activities, we provide them with examples that are relevant to their age. In middle schools, we use cartoonlike characters, such as Harry Potter searching for an appropriate spell (Figure 3). In high school, the examples are more tailored to interests like finding someone to hike with or playing games. We provide students with templates for how to accomplish the design tasks, such as brainstorming, creating storyboards, interaction flows for an app, or creating prototype wireframes.

The charrette is customized for different lengths of time (one to five hours) by creating flexible subactivities. For example, in a one-period workshop (50 minutes), we abbreviated



Figure 2. An HCDE student guides middle school students in transferring a paper prototype to an online prototyping tool on a tablet during a charrette.

it by choosing predefined personas that students designed for, instead of having them brainstorm and identify users themselves.

#### UNDERGRADUATE STUDENTS DESIGN AND TEACH THE WORKSHOP CURRICULUM

To participate in outreach activities, HCDE undergraduates enroll in a weekly two-hour seminar (during a 10-week quarter) for service-learning credit. This seminar is led by faculty and graduate students, who scaffold the curriculum development and preparation for leading the workshop. Participants develop the charrette curriculum and learn about teaching practices, including how to manage the complexities of a K-12 classroom. During the seminar, students identify learning goals, develop or adapt curriculum units to support these outcomes, modify the curriculum for varied classroom settings, meet and interview teachers, and conduct the workshops in the schools.

Seminar students are inspired and motivated by the opportunity to introduce the human-centered design field to K–12 students. Several students expressed sentiments that align with this student's reflection: "I enjoyed hearing all the creative ideas from middle school students. I was honestly impressed by how creative they were about doing each step of the design process. Seeing all the positive reactions from the kids is something I'll never forget."

Students also gain a deeper understanding of the humancentered design field through the meta-cognitive process of learning to teach it. One student commented: "I have a much greater appreciation for teachers and...their lesson planning.... I [now] realize how much iteration and thought goes into creating...each lesson and every minute of the lesson."

#### K-12 TEACHER AND STUDENT REACTIONS TO THE CHARRETTES

We found that the charrette workshops provide a positive experience for K–12 students. In surveys administered after the workshops, the K–12 students rated the workshops overwhelmingly



Figure 3. Undergraduate students use examples to help engage middle school students in the design process. These examples mirror the activities the students are doing: identifying a user (Harry Potter), a user need (remembering spells), creating a storyboard (Harry Potter using an app to remember spells), creating wireframes (a prototype of an app to remember spells).

positively, and over half were interested in continuing to explore the field of human-centered design [5]. Teachers also found the workshops overall to be highly valuable to their students [5]. They cited the value to their students of interacting with college students, the technology design process that they could use for other projects, and being able to ask questions about college that undergraduates are best suited for answering. They often invite us to come back, and some have requested the use of our materials to apply human-centered design for their students who are prototyping apps for their own course projects.

Neah Bay principal Jennifer Sikes highlighted the value of the close one-on-one interactions between their students and the UW undergraduates during the workshops there: "Because there are so many UW students matched with our kids... they are getting that kind of closer relationship. I know that goes a long way with learning."

#### CONCLUSION

Using a framework for outreach that embraces principles of handson engagement in a discipline and a co-design approach to creating the curriculum—and that offers service-learning opportunities for undergraduate students—is a strategy that can result in effective K–12 outreach. Critical to this endeavor is having college educators who are committed to the notion of outreach. Beyond that, a lot of institutional support is required, both administrative and financial. The HCDE department offers seminars that enable undergraduates to receive credit for outreach work and funds graduate students to support outreach work. K–12 teachers welcome us into their classrooms and advocate for their students' interests. To reach underrepresented students, we partner with other university groups, such as the Pipeline Project [2].

Our efforts are most successful when the stakeholders involved (students, faculty, graduate students, departmental leadership, campus and national organizations, school teachers, and principals) can collaborate and provide support for enabling K–12 students to have hands-on exposure to STEM fields.

We envision that educators in other fields can also engage undergraduate students in creating and teaching curricula for younger students. This type of initiative can empower undergraduate students to serve as role models to younger students, to better understand their own field, and to learn how to communicate to all audiences.

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### **CONTACT US**

The HCDE team is in the process of developing a toolkit for conducting Human Centered Design Charrette workshops for K–12 students. The goal of the toolkit is to enable other educators to adapt this outreach effort to their own needs, using our framework. Please see our website [1] for further information or contact us directly at hcdek12@uw.edu.

#### ENDNOTES

- Human Centered Design and Engineering K-12 Outreach Program; http://hcde. uw.edu/about/k12
- 2. University of Washington Pipeline Project; http://expd.uw.edu/pipeline
- 3. Alternative Spring Break; http://hcde. uw.edu/videos/asb
- 4. Makah Tribe; http://makah.com/
- Rose, E., Davidson, A., Agapie, E., and Sobel, K. Designing our future students: Introducing User Experience to teens through a UCD charette. *Proc. of SIGDOC '16*. ACM, 2016, 22.

● Elena Agapie is a Ph.D. student in human-centered design and engineering at the University of Washington. She studies, designs, and evaluates technologies that help people implement positive behaviors in their everyday life. She is the student coordinator for the department's K-12 Outreach Program. → eagapie@uw.edu

● Andrew Davidson is a senior lecturer in human-centered design and engineering at the University of Washington, specializing in physical computing and HCI. He directs the department's K-12 outreach program, and is also a former high school computer science teacher. → adavid7@uw.edu

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