Using Citizen Science as a Theme for a User-Centered Design Course

Annuska Zolyomi
annuska@uw.edu
University of Washington Bothell
Seattle, WA, USA

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Resource Type Project

SYNOPSIS

Teaching students how to design and evaluate technology user experiences should be centered around understanding real-world user needs. In this project, students focus on a particular domain, Citizen Science, to motivate their learning of user research, prototyping, and usability testing. Citizen Science projects study phenomena in nature and the environment, such as monitoring the spread of invasive plant species or water quality. Citizen Science projects depend on volunteers to collect and submit data from local environments. Citizen Science is a compelling context for user-centered design because it involves multiple stakeholder groups, various front-end technologies (e.g., web and mobile), and information architecture. This project is scoped for a user-centered design and usability testing course for undergraduate computer science students. The course learning objectives are to (1) use research and design methods to develop an understanding of technology stakeholders and (2) apply that knowledge to create and refine design artifacts. This project takes the students through the design process of understanding users in real-world scenarios, building personas, then conducting two user research studies to inform and evaluate technology prototypes. This paper will familiarize readers with the structure of theme-based user-centered design instruction, the nature of Citizen Science projects, popular front-end Citizen Science technologies, and public Citizen Science resources.

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KEYWORDS

Assignment Design, Human-Computer Interaction, User Research, Usability

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1 ENGAGEMENT HIGHLIGHTS

This Open Educational Resource provides a project structure for teaching user-centered design (UCD) in human-computer interaction (HCI) using Citizen Science as a context. This project engages students in the UCD process to iteratively empathize with technology users and conduct research to inform and validate design directions. Through hands-on learning of user-centered design, students make decisions about research methods and interaction design and build creative skills. The focus of this OER is to demonstrate applying Citizen Science projects to a UCD course.

Students choose a Citizen Science project that interests them and their group, which requires researching and synthesizing meaningful and relevant content from publicly available information about Citizen Science projects and technologies. The projects are culturally relevant to the students because they chose from a diverse range of Citizen Science topics, including the conservation of environmental resources, protecting endangered species, cultivating local plant life, and identifying environmental impacts of automobile traffic patterns. Students work on translating real-world STEM scientific endeavors into human-computer interaction user scenarios, personas, design wireframes, and technology prototypes. Students gain experience making conceptual and practical interdisciplinary connections to CS with Citizen Science phenomenon and scientific research approaches. This project builds practical team-based skills required of human-computer interaction specialists since the project is heavily dependent on teamwork with clear roles and responsibilities. Instructors should scaffold team formation and high-performing teams that are comprised of students with diverse life experiences and skills. Specific engagement practices are:

- Use Meaningful and Relevant Content
- Make Interdisciplinary Connections to CS
- Incorporate Student Choice
- Encourage Student Interaction
- Culturally Relevant Pedagogy

2 RECOMMENDATIONS

Computer science students may be heavily oriented toward programming courses and back-end software engineering. However, user-centered design requires a shift to thinking about front-end development and centering user needs. This project composes multiple steps over the course. Instructors should give ample time for introducing the domain of Citizen Science, followed by individual and group domain immersion since while students have personal experiences with nature and the environment, students may not be familiar with Citizen Science initiatives or consider environmental-oriented HCI. Researching and designing for an unfamiliar domain is aligned with the user-centered design goals of students developing empathy for users and designing with others in mind.

When evaluating a potential Citizen Science initiative for UCD, two important criteria are (1) the opportunity to design end-user interfaces and (2) access to the Citizen Science initiative resources. First, the Citizen Science project must include processes for lay people—members of the public who are not official members of the organization—to learn about the project, collect data, and examine a synthesized view of the data, which can take the form of maps, aggregated data from the community, community forums, etc. These processes are the basis for students to define UCD scenarios, user stories, personas, and journey maps. Subsequently, students build upon those artifacts and their growing knowledge of the Citizen Science domain to envision and design novel end-user interfaces. Students can design for mobile, desktop, or web platforms. They can design for specific aspects of Citizen Science processes, such as data collecting which may require the user to capture and upload images, annotations, and location details of a particular environmental phenomenon. Another example of UCD design for a Citizen Science process is viewing relevant data on a map based on the user's location and interest, such as conditions of hiking trails impacted by weather conditions. Second, students, with guidance from the instructor, should select a Citizen Science initiative that is currently active and will remain active for the course duration. Access to the initiative helps ensure that students can access necessary technology, such as the website or data collection application since these technologies serve as a starting point for student design work.

3 SCOPE OF PROJECT MATERIALS

The project materials focus on describing citizen science and the multi-step project. The project entails the following activities: (1) using online resources to gain an understanding of the domain of Citizen Science,(2) building personas and journey maps, (3) conducting user research (e.g., diary study, survey, interview) about users and context of use, (4) iterating on personas and journey maps, (5) creating an interactive prototype, (6) conducting a usability test of the prototype, and (7) synthesizing their learning into a user experience portfolio. Since the scope of this OER is on applying Citizen Science to UCD, materials emphasize tailoring those activities for Citizen Science. Courses can use books dedicated personas [4], journey maps [3], usability testing [1, 5], and user experience in agile development [2] for foundational concepts and recommended process.

4 CREATING INTERACTIVE PROTOTYPE

Students create an interactive prototype for their usability study. There are three main requirements for the prototype:

1. The prototype is interactive (meaning the user can interact with user interface elements, enter text, and the prototype reacts accordingly. 2. The prototype supports primary tasks and user experience that the team has identified as necessary for the user experience and goals of the Citizen Science project. 3. The prototype is stable and does not generate error messages, so research participants have a baseline, usable experience.

The prototype is an implementation of the user interface and user interactions, not back-end functionality. Therefore, for research purposes, the prototype should be low- or medium-fidelity. It can include "Wizard of Oz" functionality behind the scenes. The teams select which prototyping tool they want to use, including paper prototyping, Figma, and a strawman website or application.

5 RELATED ONLINE RESOURCES

Readers can find information on the motivation and approach of Citizen Science, as well as pointers to specific projects, at the following websites. The "Student Resources UCD Course Project with Citizen Science Theme" document lists additional resources.

- National Geographic: https://www.nationalgeographic.org/idea/citizen-science-projects/
- Citizen Science Global: http://citizensciceglobal.org/
- Citizen Science: https://www.citizenscience.gov/
- European Commission Science Hub: https://joint-research-centre.ec.europa.eu/index_en

6 MATERIALS

For this project, students benefit from a clear overview of the UCD group project and an introduction to Citizen Science. Instructors can provide overview content during a lecture, supplemented by a written summary. The instructor can present a list of major milestones in the project and, as the course progresses, show current project status by checking off the recently completed milestones and highlighting the next milestone.

- Instructor Guide UCD Project for Citizen Science
- Lecture Slides UCD Project for Citizen Science
- Student Overview of UCD Project
- Student Overview of Citizen Science Domain
- Student Resources UCD Project for Citizen Science

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[3] Jeff Patton. 2014. *User Story Mapping: Discover the Whole Story, Build the Right Product* (1st edition ed.). O'Reilly Media, Beijing ; Sebastopol, CA.

[4] John Pruitt and Tamara Adlin. 2006. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design* (1 edition ed.). Morgan Kaufmann, Amsterdam ; Boston.

[5] Jeffrey Rubin, Dana Chisnell, and Jared Spool. 2008. *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests* (2 edition ed.). Wiley, Indianapolis, IN.