**Instructor Guide for User-Centered Design Project for Citizen Science**

**This guide supplements the student-facing materials for conducting a UCD project with the theme of Citizen Science. The emphasis of this guide is on aspects related to incorporating the Citizen Science into a UCD course, not on teaching UCD in general.**

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# **Selecting Citizen Science Initiatives**

The instructor’s guidance is important for teams to select a Citizen Science initiative that is publicly available and has opportunities for creating or re-designing end-user technology capabilities. The instructor should provide example Citizen Science initiatives for the students to explore in their domain immersions, plus encourage the students to brainstorm on additional initiatives that match their personal interests. UCD projects on these topics have been fruitful for UCD students:

1. Cloud Science initiatives (e.g., [GLOBE Observer Clouds](https://observer.globe.gov/do-globe-observer/clouds))
2. Light and noise pollution (e.g., [Globe at Night](https://www.globeatnight.org/))
3. Pollinator Citizen Science (e.g., tracking bee populations)
4. Bird conservation (e.g., [The Cornell Lab of Ornithology](https://www.birds.cornell.edu/home/citizen-science-be-part-of-something-bigger/))
5. Monitoring invasive species
6. Citizen Science for automobile traffic monitoring

As conveyed to the students in the Lecture Slides UCD Project for Citizen Science, here is the criteria for the Citizen Science initiative and related technology with additional guidance for instructors:

1. Team has access to the Citizen Science publicly facing information (initiative is active, website available, apps (if applicable) are functional and in public domain
   * Check the initiatives project information for potential end dates that interfere with your course
2. Team has access to people who are or may be interested in participating in this type of Citizen Science initiative
   * The teams can reach out to active participants of the initiative that the team does not know. Outreach avenues include the initiative website, in-app affinity groups, social media like Reddit.
   * The teams can conduct their UCD research with family, peers outside of the class, family, co-workers, etc. A broadly appealing initiative will be easier to recruit participants from students’ existing networks.
3. Citizen Science initiative contains data viewing and collecting processes for public, community involvement
   * Some students will be drawn to specific technologies such as maps, data visualizations, artificial intelligence, and data management of crowd sourced data. The use or envisioned use of these technologies for a given Citizen Science initiative can be an effective hook for computer science students.
4. Explore a unique aspect of Citizen Science not explored by another team in the class
   * This requirement helps foster diversity in approaches throughout the class and makes cross-team reviews more interesting.
5. Meet quality of work to highlight in a user experience portfolio
   * This requirement often elevates the students’ goals for their UCD artifacts. Some students may wish to produce a technically oriented portfolio, rather than a UX-focused portfolio. Instructors can encourage students to consider how they want to showcase their work to potential internship and job hiring managers.

# **Exploring Ethics and Policies Related to Citizen Science Technology**

Citizen Science initiatives are concerned with civic engagement in areas including the environment (e.g., climate justice, sustainability) and public health. This is an opportunity for computer science students to better understand the role of technology in these broad societal and ethical challenges. The UCD process helps to center the priorities and values of stakeholders, so it is important that their UCD explorations actively engage with people with diverse lived experiences, knowledge, and goals. However, some students may fail to see or resist delving into such topics, especially if they are very focused on technical skills or usability metrics like performance or efficiency. Therefore, the instructor can encourage students to explore topics related to nature, environment, and community activities more broadly as entry points into Citizen Science, which require crowd-source and research elements. Students may find an entry point through emerging technology such as artificial intelligence and sensing technologies, and then be able to reframe their interest in terms of how those technologies may be useful for Citizen Science.

Another strategy for engaging students in Citizen Science projects is to invite guest speakers who are involved in initiatives on campus, in the local area, or remote. Guest speakers who are on the ground with these initiatives make the topic more compelling, surface complexities of the initiative, and highlight issues with community projects, ethics, and technology. Ideally, these guest speakers would return at the end of the quarter (or semester) to listen and provide feedback to team presentations.

To contextualize their projects in the broader discourse of socio-technical interventions, the class can discuss issues related to the democratization of science, technology in the public versus private domain, and intellectual property (IP). Situated in their projects, students could identify issues of “trustworthiness” of technology and related policies and practices. This includes issues around IP, data ownership and management, security, privacy, and accessibility. The instructor could facilitate a “trustworthiness” activity for the teams to explore ways to address challenges and mitigate risks to various stakeholder groups.

# **Project Activities**

In this multiple-step project, you will facilitate student teams through key steps of user-centered design. The outcomes and learnings from each step build upon each other. This iterative, team approach aligns with how technology companies generate user research insights and integrate them into the product development lifecycle.

A crucial element of teaching this project is facilitating student team work. The teams form towards the beginning of the term and last the duration of the team. Teams can be formed based on having common interested related to Citizen Science topics, skills the students have and want to develop, diversity in lived experiences, and their schedules since teamwork will be required outside of class time. It is advised for instructors to offer “studio” time within class sessions to help facilitate active engagement of all team members and to be available for consultations. As the project progresses, an effective strategy is to have the students do individual or in-class activities that provide an initial experimentation with the UCD activities and then have the teamwork be building upon that knowledge and their emerging skills. To encourage team planning, delegating tasks, and accountability, they should state each member’s roles and responsibilities for key team assignments. The roles can indicate who is on-point for a task and are not intended to mean that the student must complete all work associated with that task. Helpful roles for UCD projects are participant recruiting, creating the research protocol, coordinating data analysis, writing specific report sections, editing, and owning different aspects of design. For UCD activities that involve direct interaction with research participants, it is advised that each student be responsible for at least one user session so that every student has that learning experience.

It is important to stress the experimental and iterative nature of UCD, especially given the constraints of a class-based learning environment. The schedule can often feel rushed, especially in a quarter-based system (See the Sample Schedule table at the end of this document.) Also, the instructors and students are balancing learning new concepts and applying them individually and within a team. It is helpful to emphasize that engaging in the process of UCD is the crucial activity; the UCD artifacts are iterated upon and developed as their knowledge of the Citizen Science domain deepens throughout the course.

Currently, the COVID-19 pandemic presents significant challenges for engaging in UCD. The students should be advised to conduct all research under the current university policies for COVID-19 precautions. This often requires research interviews and usability studies to be conducted remotely. The team should include their plans for following safety precautions in their research plans.

The project is divided into two main phases of research, formative and evaluative.

Formative Research (50% of project grade)

1. Initial domain immersion based on secondary research and guest speakers (if feasible)
2. First iteration of personas and user journey maps
3. Conduct formative user research (e.g., diary study, survey, interview) to refine their understanding of the Citizen Science stakeholders, current technology, and context of use (setting, collaboration, communication, etc.)
4. Iterate on personas and user journey maps based on formative research

Evaluative Research (50% of project grade)

1. Create an interactive prototype
2. Conduct a usability test of the prototype
3. Synthesizing your learning into a user experience portfolio and report

## **Guidance for Key UCD Activities and Artifacts**

This section presents guidelines and details for specific UCD activities and artifacts. This Instructor Guide is not intended to be a fully resource for teaching UCD; however, this section suggests guidelines and details for specific UCD activities and artifacts to demonstrate how to balance teaching UCD overall and incorporating the rich domain of Citizen Science. **See the Student UCD Project document for guidelines for team presentations, demos, research report, and portfolio.**

## **Building Personas**

Personas are aggregated information about current or potential customer groups. In the technology industry, effective personas are data-driven based on market and user research. In the context of a course, a more realistic version of personas are proto-personas. Proto-personas are used in agile development environments and capture the essence of a persona informed by observations, knowledge, and data available to the team. A proto-persona is lightweight and can include assumptions that the research group wants to explore further. The instructor should determine whether the class uses the terminology of persona or proto-persona.

User attributes commonly included in personas include:

* Demographics (e.g. age, gender, occupation, income, family status, education)
* User roles (e.g. teachers, students, administrators, etc.)
* Level of prior experience in the domain (e.g. expert, novice, heavy, frequent, intermittent)
* Social, emotional, cognitive, and human factors
* Technological tools, habits, and preferences
* Other user resources or constraints that may impact the design
* A photo (You can use a photo you find online. However, do not use a celebrity photo or celebrity name. It detracts from your persona because people will associate your persona with attributes of the celebrity.)

Resources:

* Just in Mind blog and persona templates: https://www.justinmind.com/blog/user-persona-templates/
* Mural.com blog about personas: <https://www.mural.co/blog/boost-empathy-quickly-with-proto-personas>

## **Developing User Journey Maps**

**User journey maps are models of the phases of a technology-supported journey. Journey maps focus on a specific persona, identify key phases, and highlight the ups and downs of the journey as they attempt to meet their goals. Students can find it challenging to construct a journey map, especially early on in the UCD process and as they are still establishing team norms and processes. It is helpful to use the journey maps as a tool for the team to articulate their conceptual models of the Citizen Science phases and how technology is currently being used. The teams will iterate on their journey maps after completing their formative user research, and thus, gives students first-hand experience with the value of the iterative UCD approach.**

**Resources:**

* **Nielsen Norman Customer Journey Mapping 101:** <https://www.nngroup.com/articles/journey-mapping-101/>
* **HubSpot Customer Journey Mapping:** <https://blog.hubspot.com/service/customer-journey-map>
* **UX Hints Customer Journey Map Template:** <https://uxhints.com/ux-research/customer-journey-map-template/>

## **Planning and Conducting Formative User Studies**

The goal of the formative user research study is to deepen understanding of stakeholder goals, activities, and technology use for Citizen Science initiatives. The scope of the research study is to investigate 2-3 overarching research questions. Within the context of the class, this is a lightweight study in terms of number of research participants and how you will analyze the data. Also, students will need to scope their preparations, data collection, and data analysis to be reasonable within the timeframe of the assignment. Each team should select an appropriate research method for their project, given your current research questions and ideas for enhancing the domain you're researching.  Typical research methodsare:

* Online survey (aim for at least 5 survey responses per team member)
* Interview (at least same # of participants as # of students in your team)
* Initial, micro-usability test of a particular, existing technology (at least same # of participants as # of students in your team)
* Diary study (at least same # of participants as # of students in your team)
* Expert heuristic review (at least 3 expert participants)
* Focus group (4 person team = at least 1 focus group; 5 person team = at least 2 focus groups)

## **Planning and Conducting a Usability Study**

Based on student learning from their formative research and in-class design thinking activities, they should now have some key user needs in mind and an understanding of what the current technology can offer. Each team will conduct 1 research study during this phase: a usability study.

Conducting the usability test requires that the teams establish 2-3 scenarios that will be supported by their prototype. During the usability test, the student research will ask initial interview questions, ask the participant to think aloud as they attempt to perform 2-3 tasks per scenario, and ask concluding interview questions. Each team member needs to conduct at least one usability session with a participant. It is reasonable to expect that each session lasts about 30 minutes.

## **Creating a Technology Prototype for Usability Testing**

Each team creates an interactive prototype that they will evaluate with a usability study. The prototype should be designed to fulfill a core aspect of the Citizen Science initiative the team has been researching thus far. The teams decide on their approach for the prototyping, which is either:

1. Base the prototype design on an existing product (e.g., a website or application) that supports Citizen Science. Examples:
   1. Enhanced website for Traffic and Road Detection (Existing webpages for registering and setting up sensing device on car; 5 new screens for reviewing personal route information, reviewing uploaded images, classifying objects in images)

OR

1. Design your prototype from scratch. (It will most likely be informed by your secondary research on existing products and sites). Examples:
   1. New mobile application for Cloud Science initiative (12 screens; 30 mockup screens in PowerPoint with sample data to support usability tasks)
   2. New mobile application for Noise Pollution initiative (12 screens in Figma, all screens with at least 4 interactive elements that link to other screens)

Scope of design to evaluate:

For either approach (1) or (2), The instructor should establish what degree of change they expect. The prototype should support 2-3 key scenarios. Within each scenario, there should be 2-3 tasks that the end-user can perform.

If a team is going with approach 1, then one barometer for design changes is the number of screens modified (e.g., 5) and number of new screens (e.g., 2). These numbers depend on the technology platform since websites usually contain more design elements and functionality than a mobile application. The instructor should strive for consistent effort across teams.

During the usability tests, the student researchers will observe the participant attempt the tasks provided by the researcher. The team should identify the key usability metrics they are most interested in regarding user satisfaction, effectiveness, and/or efficiency. Based on team data analysis, they will make a final set of design recommendations and identify useful next steps for research.

Resources:

Usability.gov System Usability Scale (SUS): <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

International Standards Organization (ISO) Usability Definitions and Concepts: <https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en>

## **Example Course Schedule**

**Table 1:** Example UCD Course and Project Schedule for a Quarter-Based Course

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Lecture Topic** | **In-Class Activity** | **Individual Assignment** | **Team Project Assignment** |
| 1 | Overview of HCI and User-Centered Design | Icebreaker; | Initial domain immersion into Citizen Science |  |
|  | Intro to user research and usability studies; Overview of Citizen Science domain | Guest speaker on Citizen Science; Observe video of usability study | Prep for micro-usability study |  |
| 2 | Secondary Research | Select Citizen Science related topics for field research assignment | Field research: observing people; Conduct micro-usability study | Class brainstorm on Citizen Science topics |
|  | Experience Modeling; Proto-Personas | List of characteristics for proto-personas | Proto-personas | Form teams and select Citizen Science topics |
| 3 | Understanding current state; Journey Maps | Teamwork time for group domain immersion | Heuristic review | Group domain immersion - Journey Map |
|  | Formative Research Methods, Interviews | Observe example interview | Initial research Questions |  |
| 4 | Formulating Research Direction | Team draft Hunt Statement | Readings on research methods | Team Hunt Statement |
|  | Surveys, Diary Studies | Practice peer interviews |  | Select research method; Draft research protocol |
| 5 | Logistics of Formative Research Study; Ethics in UCD | Review team draft research protocols (e.g., survey questions, interview questions) |  | Plan for formative research study |
|  | Qualitative Data Analysis; Generating Research Insights | Sample Citizen Science project - survey data analysis | Qualitative data analysis | Launch formative study |
| 6 | Design Thinking; Ideation: User Stories |  | User stories |  |
|  | Storyboards, Sketching | Iterate on Personas & Journey Map | Revised formative research artifacts | Formative research study report; Peer feedback |
| 7 | Scenarios and Tasks; Evaluative Research: Usability Testing | Scenarios, Tasks, Storyboards | Ideation artifacts | Set design direction |
|  | Design Ideation - Prototyping, Wizard of Oz, Wireframes |  |  | Plan Usability Test |
| 8 | Conducting Usability Test | Practice usability test |  | Usability Script |
|  | Collecting and analyzing usability metrics | Sample Citizen Science Project - Quantitative Data Analysis |  | Initial prototype mockup |
| 9 | Participatory research and co-design | Practice card sort | Card sort results |  |
|  | Guest Speaker (UCD in Practice) |  | Reflection on guest speaker |  |
| 10 | UCD Influence and Storytelling; Public /Private technology and data | Review UX Portfolios; “Trustworthy” Ethics and Policies activity | Identify and mitigate issues around “trustworthiness” of technology policies and practices | Usability Study Report |
|  | Course in Review |  | Lessons learned | Team Presentations |
| Finals | Course Wrap-up | Portfolio Reviews |  | Team Presentations, cont..; Peer feedback |