

**Project Title: Enhancing Public Interest Technology Education: A Multi-Program Collaboration To Enrich Interdisciplinary, Experiential Curriculum - Sponsor Award ID 009317**

**Summary of key findings/results**

This project ultimately aimed to advance the field of interdisciplinary and experiential teaching in PIT by synthesizing and disseminating best practices through open source and easily accessible resources including a PIT curriculum, framework, and guidance, and community-based student project guidelines. In order to better incorporate Public Interest Technology (PIT) values, we have identified additional areas of inquiry: establishing common frameworks and shared vocabulary for working across disciplines; assessing effective approaches to teach and engage students with varying knowledge and skill sets, and determining a baseline curriculum that non-technical students need to thrive in this field. The work consists of community examples as teachable case studies and an adaptable experiential learning curriculum module. Throughout the materials, there are technical, ethical and policy dimensions that are broadly applicable for interdisciplinary students.

**Curriculum Development**

The curriculum was developed to be valuable to students from various educational backgrounds. Analyzing societal impacts involves a humanities-oriented thought process while understanding or familiarity with existing technologies may appeal to a student from a STEM background. As it is possible to go through a technical degree or occupation without immersing oneself in ethical questions, there is immense value to teaching values to students interested in technology. After engaging with this curriculum, students will be equipped to analyze reflective questions including “why am I doing the work I am doing?”, “for whom am I doing this work?”, and “in what ways does this work address a human or societal need?”. Students in project-based courses will be able to identify, assess, and apply ethical values in the works of other entities as well as their own to promote the creation of ethical technology. By completing the activities in the module, students will be able to: 1) identify, assess, and critique ethical values of existing technologies as they would have experience doing so using case studies and 2) identify, assess, critique, and apply ethical values to their own technological design projects. An integral part of the PIT curriculum included case studies that teach students how to analyze existing technologies with a more critical lens toward ethics.

**Values-Based Framework**

Developing a list of values that allow for work across disciplines required reconciling similarities across existing curricula related to PIT, human-centered design principles, and values-driven features related to technology such as open-source, accessible, and fair. The values list is also derived from an assessment of effective approaches to teach and engage students with varying knowledge and to determine an approach that non-technical students can use to thrive in this field. When coming up with this list of values, it was important to balance what the public thinks is important with what was discovered in this research. Below are the values and definitions that provide a basis for the curriculum module.

**Pre and Post Survey Assessment**

To capture learning outcomes, a pre- and post-survey was sent to 34 students in UC Berkeley’s Fung Fellowship. The study was set up to measure students’ attitudes, beliefs, knowledge, and skills related to PIT concepts. The pre-post-survey format allows for assessment of whether the curriculum led to knowledge gain and mindset shifts. The pre-post survey data can be reported qualitatively through text-based analysis of written responses and quantitatively by assessing Likert scale (ranked 1 through 5)

questions through the Wilcoxon-Rank Sum test.

### **Background and Problem Definition**

***a. What was the project's main objective? b. What was the initial problem you wanted to solve? c. Who/what are other individuals or institutions working on similar projects? d. Did you work with other teams or institutions as partners? If yes, how? e. How did you define diversity, equity and inclusion with respect to your work?***

Our original objectives were to 1) Identify gaps and opportunities for the Fung Fellowship in relation to Public Interest Technology (PIT) efforts across campus; 2) Build on our well-developed curriculum to enhance elements concerning digital fluency and the ethical and societal implications of tech; and 3) Pilot our enhanced curriculum with campus partners. This guided our development approach and a starting place for how we would accomplish our goals. With further refinement of our focus and project we formalized our objectives to be applicable to a broader audience and realized the focus of the work was more needed and more challenging than originally anticipated.

#### **Project Objectives:**

1. Survey the current PIT field and research existing materials on the subject to identify areas of opportunity in interdisciplinary and experiential curricula.
2. Build a module that teachers can use to integrate ethics throughout their curriculum development to foster student ability to assess technology and data collection with regard for social good.
3. Pilot the enhanced curriculum with campus partners, testing the learning with students of non-STEM and STEM backgrounds.

Core to our approach was to engage with stakeholders in both the private and public sectors. This was so that our work was informed by what has been done and what was needed in this emerging field. Throughout the project we work closely with other institutions, Faculty, students, and organizations to provide feedback on our progress and share best practices. Our launch event was hosting the first Public Interest Technology Summit at UC Berkeley (UCB). This event brought together UCB staff, faculty, and students, as well as community and government organizations, and PIT-UN members with the goal of collaborating on PIT programming at UCB and identifying opportunities for curriculum development and collaboration. The event brought together diverse stakeholders in the PIT space to discuss best practices and challenges in teaching PIT, required skills, and career pathways. The format included lightning talks, panel discussions, hands-on/interactive demonstrations, and breakout/brainstorming sessions. Insights from the event have informed the development of our PIT curriculum for both technical and non-technical students alike. Interest and engagement in our effort (one success metric) has been high with 20+ organizations within UCB (staff, faculty, students) and many external participants (City of Berkeley, Stanford, UC Santa Cruz, ACLU Kapor Center, AI4ALL) focused on experiential education. The community and government organizations in particular provided insights into PIT job opportunities in addition to the preferred skills for new hires in the field, all of which helped to better inform the design and learning objectives of our curriculum. While the summit initially brought together these diverse stakeholders, we also continued to engage them in focus groups and one-on-one interviews throughout the rest of the year as we developed our curriculum and coalesced our PIT efforts. The participating campus-based programs included: Haas School of Business; CITRIS Policy Lab; Human Rights Center; Division of Computing, Data Science, and Society; Blum Center for Developing Economies; and the Othering and Belonging Institute. Student participants from UCB came from various units, programs and

student groups including: School of Information; Electrical Engineering and Computer Science; Graduates for Engaged and Extended Scholarship in Computing and Engineering (GEESE); Fung Fellowship; School of Public Health; Division of Computing, Data Science, and Society; and the Department of Sociology

We define diversity broadly to include identity gender, race, ethnicity, age and expand to include discipline, life experience, skills, perspectives, and cognitive diversity. At FF we believe diverse teams develop better solutions, especially as those solutions will be used by diverse stakeholders. This diversity of thought and experience is essential to solve the complex challenges facing society. We also ground the community project experience in human-centered design which builds mindsets and skills in empathy and equity. Our student teams are designing tech solutions for society's most marginalized populations which makes this mindset imperative to the work.

Diversity and equity are the cornerstone of the program. We recruit students underrepresented in tech and innovation (URMs, first-gen, transfer students, military veterans, and women) and across majors (e.g., engineering, arts, humanities, public health, and biosciences). To date, our Fellows represent 69% racial and ethnic minorities, 59% women, 27% first-gen, 22% transfer, and 17% veterans. Similarly Cal NERDS serves LGBTQ, low-income, first-gen, URMs, student parents, transfer/re-entry, disabled, foster, undocumented, system-impacted, and women. Jacobs is the inclusive hub that brings these students together to collaborate across disciplines, expertise, and demographics.

### **Development**

***a. How did you first approach the project? i. What were the intended methods and processes you wanted to use? b. What changes did you make to the project? i. How did you adapt to any changes in circumstances for the project? c. How did you evaluate the success of the project? d. What are the next steps in your project and how would you scale it, if possible?***

One major goal for this work was to develop an undergraduate PIT curriculum for technical and non-technical majors that teaches them to critique their tech solutions using a public interest lens. During this process of developing the curriculum, we explored many disciplines (social sciences, humanities, and STEM fields) and modalities for teaching PIT. We realized many gaps and inconsistencies in the types of material that is taught related to ethics especially around technical ethics. With this being an emerging field we see lots of opportunities for alignment and consistent frameworks across fields and ultimately helping guide PIT especially for those that are new to the field. Additionally, we identified the need for hands-on policy training to augment our students' project-based classroom experience. Policy training is needed in our program because it is the means by which our students operationalize the ethical, legal, and societal implications of the technologies they design. A well-rounded PIT education should teach students how policy affects technology development, how to develop effective policy interventions, and what career pathways are made possible through PIT policy training.

To date, we have surveyed the UCB and national landscape for PIT related coursework, syllabi, and curriculum and conducted a literature review of PIT teaching resources and related content. We followed up with several attendees from the summit to get further insight into the challenges and best practices of teaching PIT and their pedagogical approach. Additionally, we identified key terms and content areas to be included in the curriculum and developed an early-stage curriculum framework.

From the literature review we consolidated themes, key words, readings, and activities used in different courses. These resources are beneficial in aligning our curriculum with the work that has been done in this field to date. Most of the resources we surveyed focused on specific technologies (e.g., algorithms) or were discipline specific. Additionally, the literature review and discussions we have had at meetings and conferences highlighted that many PIT courses focus on computer science/coding or data as the technology being developed/implemented. We plan for our curriculum to be tech agnostic, meaning that students and project teams can use it no matter the type of technology they are developing, from an algorithm to a digital product to a physical device

Work to date includes an overlay of our PIT framework with the human centered design approach, thereby allowing students to use it as a lens as they develop their tech solutions. Similar to how students progress through the design of technology, we are infusing that process with key milestones for assessing the societal and ethical aspects of their designs and its implementation as it relates to multi-level stakeholders (e.g., user, beneficiary, and buyer). The curriculum modules can thus be used in any experiential, project-based tech and innovation course. These “starter” modules for PIT provide students with an introduction to the ethical and societal implications of their work and how to apply these theories to the development of tech.

The students have been instrumental in sharing what they have learned in previous courses and what more is needed to sufficiently prepare students to consider the ethical implications of tech. One gap that was identified from our initial development was the disconnect between learning and doing. More work is needed to connect the ethical considerations directly to the application of tech development so students can learn by using a scaffolded approach. For instance, our pedagogical framework utilizes an integrative approach rather than modular learning to allow multiple cycles of learning that reinforce the terminology and concepts introduced to the students. A key component is to focus on both negative (what to avoid) and positive ethics (what we can do) to frame the curriculum in a way that empowers students and allows them to practice exploring ethical questions and practical interventions. Grant funding also supported staff and faculty to provide guidance and expertise to the development of our curriculum. We have been working closely with the Division of Computing, Data Science and Society and their work with the human context and ethics curriculum applied to data science courses.

In addition to the major activities described above, we learned from and contributed to the larger PIT-UN community at conferences, online workshops, and events. Once complete, we will present our work and disseminate our findings to the PIT-UN network and make them available to a broader audience on our website.

[REDACTED]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

**Lessons learned**

- a. How would you summarize your insights?***
- b. What specific advice would you offer to other members concerning this project? c. What specific changes at a departmental or institutional level would have made your project more effective or impactful?***

Through the work we have done we recognized the importance of scaffolding the curriculum for the students' learning. By presenting too many concepts without the space for them to apply and practice these concepts as individuals or in pairs, small groups, and/or project teams, we risk the content remaining conceptual. While project based courses will provide opportunities for the application of the curriculum, we also realize additional training opportunities will be needed specifically for undergraduate students. Most opportunities currently focus on graduate and postdoctoral students. This was something that was also highlighted in our discussions and breakout sessions at the summit event. The need to better scaffold our curriculum also illuminated the fact that it would be challenging to sufficiently cover pertinent topics to PIT. A primary example of this is policy awareness and implications as it relates to the technology the students are developing. While we will introduce policy implications of technology, the students first have to understand ethics and

values associated with the practice of public interest tech before they can then move on to a deeper conceptual understanding of policy and how to engage and interact with policy concepts. Because of this we realized there is a need for additional training and experiential opportunities outside the classroom for undergraduate students to engage in PIT. Complimenting the course and project based experience with additional experiential learning opportunities will allow students to explore PIT in more depth and in a broader context across different applications. Through discussions with stakeholders and experts from the summit we realized that policy (government and industry-led initiatives) plays a central role in ensuring technology serves the public interest.

Currently, navigating course credit limitations and barriers make it challenging for undergraduate students to participate in the few PIT opportunities on campus, including course offerings, research and experiential learning opportunities. There is high demand from Berkeley students for PIT skills, opportunities, and formalized PIT programs (e.g., certificates, course threads). From our previous work, we know that the majority of PIT efforts on campus focus on opportunities for graduate students. This provides an opportunity for the development of a course of study for UCB undergraduates that provides a comprehensive overview of the theory of technology in society from diverse fields and the ability to put these theories into practice through experiential learning. There is also both graduate and undergraduate student interest in a PIT certificate that certifies their learning.

Through the research we have done thus far, we have discovered a number of insights that would be beneficial to the PIT community more broadly:

**Insights:**

- There is an overwhelming demand from Berkeley students for PIT skills, opportunities, and formalized PIT programs (certificates, course threads).
- Current academic PIT practitioners are looking to connect and partner with peers both at and beyond campus and discover ways to streamline partnership development.
- Flexibility and embracing uncertainty are beneficial skills for students to learn and practice while training in PIT.
- PIT projects benefit from diverse and multi-disciplinary teams as we have seen in other fields (design, innovation, technology).
- Curriculum should be centered on explorations of values for individual students and teams, all in relation to technology.
- Encourage self-reflection and awareness of one's ethical-positionality, make explicit ideas of "public interest" and "social good," to help students understand value tradeoffs and different ways of defining values by diverse stakeholders.
- We must ensure that these efforts still provide a rigorous education for our students.

**Challenges:**

- Effectively bringing together the numerous and diverse groups and disciplines on campuses that already do PIT-related work in a consistent ongoing cadence.
- Ensure that faculty across the university recognize how they can contribute to PIT and make it a priority.
- Cohesive university support to assist faculty in collaborating across disciplines.
- Developing novel ways of assessing PIT learning, consistent with the innovative nature of the curriculum while working with UC Administration's assessment practices.
- Navigating course credit limitations and barriers that might make it challenging for students

to participate in PIT opportunities on campus (courses, certificates, fellowships).

**Open Questions:**

- What are the most effective strategies for teaching groups of multi-disciplinary students?
- How receptive is the academic community to creating more interdisciplinary learning opportunities?
- How to best involve industry, community, and government partners and develop reciprocal and ongoing relationships?
- Which campus partners are we leaving out of the conversation who should be at the table?

**Possibilities to replicate**

***a. How can other members replicate the project, or part of the project?***

***b. What considerations should other members have when approaching your challenges?***

***c. How can the Network support opportunities to replicate your project's success?***

We are making our framework, resources, and curriculum open source to be accessible for replication and dissemination. We are also currently working to publish our efforts so others can learn from how we developed and implemented the PIT curriculum while also sharing best practices. Our work and curriculum modules are meant to be used as needed based on the time and needs of the course and students. We are working to make them more accessible to a wider audience while also providing a system to guide instructors of how to use the material and suggested prioritization if there is limited resources, bandwidth, or time within a classroom setting.

A key to successful work is collaborating with other stakeholders and colleagues who are working in this space. It is disparate and nascent so it needs even more of a foundation of support to develop consistency across the field. Additionally, involving students and co-designing with them is key to our success with this grant and also for our program. More of these efforts will ensure the content, curriculum, and programs are student driven.

**General Information**

***a. Who can be contacted to get more information?***

***b. What is the current state of the project?***

Please contact the PI Jennifer Mangold at [jmangold@berkeley.edu](mailto:jmangold@berkeley.edu) for more information or opportunities to collaborate. We will be continuing this work for the next several years and it would be great to continue to collaborate with other organizations and colleagues. We are currently in the phase of revising our curriculum based on the pilot phase and preparing for publication.

**Annexes & Publications**

***a. Please attach copies of any media or publications regarding this project.***

***b. Please attach copies of any materials developed as outcomes for your project including links to where materials may be stored.***

Once our results have been finalized I will share all the open source materials that we created with the network and broadly.