



# Arizona State University

## Public Interest Technology Case Studies

## Arizona State University

Arizona State University (ASU) is a very large state university classified as Carnegie R1 (doctoral university - very high research activity). ASU graduates over 27,000 students each year across 800 undergraduate and graduate programs, of which 39 of these programs are considered in the top 10 in the USA. ASU is particularly well-positioned in science, technology, engineering, and mathematics (STEM) education, with more than 51,000 students across various STEM fields varying from psychology to computer sciences to human origins to sustainability to space exploration. US News & World Report has recognized ASU as one of the top 50 public universities in the country and as the nation's most innovative university (seven years in a row). The Times Higher Education impact ranking also recognizes ASU as the top university in the US and among the top in the world in contributing to the UN Sustainable Development Goals.

ASU is a leader in Public Interest Technology (PIT), in large part due to the comprehensive approach it has taken to implement the "design aspirations" of the New American University and through its Charter. The design aspirations, particularly "conducting use-inspired research," "being socially embedded," "fusing intellectual disciplines" and "transforming society," are a virtual blueprint for creating an approach that foregrounds PIT. In 2014, ASU adopted a Charter that measures success "not by whom we exclude, but rather by whom we include and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves." The Charter both inspires and legitimizes PIT.

To date, we have catalogued 116 projects across ASU as PIT activities. We have categorized these activities into 5 themes: Learning; Scholarship, Research, and Innovation; Operations. Engagement and Collaboration; and Justice, Equity, Diversity, and Inclusion.

### Case Study

# Learning



**PIT learning is about training future leaders to tackle the next century's socio-technical challenges while advancing public values like sustainability, justice, human health, and the well-being of the planet and all of the creatures that live on it. PIT learning explores new ways of transmitting knowledge to diverse audiences according to their needs and priorities. It also develops the hard and soft skills needed to bring about positive change, creating solutions that will promote the public good, rather than (or in addition to) the private interest. PIT learning programs may be formal or informal, facilitating ends-oriented academic pathways and empowering tinkerers to create a rich PIT ecosystem of curricular and co-curricular programs. Key to such programs is promoting interdisciplinarity across STEM, the social sciences, the arts, humanities, and the professions.**

## 1. Master of Science in Public Interest Technology

**College:** College of Global Futures, CGF  
**Department/School:** School for the Future of Innovation in Society - SFIS  
**Director of Program:** Robert Cook-Deegan  
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**Director of Program:** Wendi Taylor  
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**Website:** <https://asuonline.asu.edu/online-degree-programs/graduate/public-interest-technology-masters>



### How the program fits the learning theme

There is a need to create professionals fluent in tomorrow's technologies, capable of anticipating how they might be used and whom they will affect. The Master of Science in Public Interest Technology (MS PIT) centers on identifying emerging technologies and ensuring those technologies promote sustainability, justice, human health, and the well-being of people and the environment in which they live. Arizona State University's School for the Future of Innovation in Society (SFIS) developed the nation's first Master of Science in Public Interest Technology, to fill a gap in technology and technology policy that too often centers on financial and technical outcomes, rather than public purpose.

### Program description

The MS PIT is designed to train tomorrow's leaders to imagine, design, create, and apply technology to promote the public good. The program equips students to assess new and emerging technologies, engage with community stakeholders, identify issues that are of interest to communities that will be affected, build toward public consensus, and deploy technologies that will benefit humanity and the physical and social environments. Students will also gain or refresh their technological fluency. The premise is to co-design with people, the end-users, throughout the process from deliberation to action. Students in the program will learn or improve skills needed to become effective advisors and transdisciplinary thinkers, helping shape positive futures with communities and societies locally and globally.

both consumers and global citizens. Graduates work to address sociotechnical problems such as humanitarian crises, inequity, privacy encroachment, data security breaches, inaccessibility of information, energy inefficiencies, unsustainable or destructive business practices, and issues of empowerment, transparency, and oversight. Founding Director of the program, Professor Katina Michael, emphasizes that “PIT is about process, not just shiny gadgets.” Technology is about many elements including debate, deliberation, and dialogue. Those processes are not merely technical, but they entail bringing humanistic values and social science methods into the disciplines of science, technology, engineering, and math (STEM).

MS PIT is a fully online program, designed to reach students anywhere they are, regardless of borders and administrative boundaries. From day one, students are exposed to multicultural perspectives as they learn about diverse socioeconomic and sociotechnical systems and modes of working across institutional, state, and national borders.

#### Program details

Students take 4 required core courses of 3 credits each, and then take 15 credits of electives in a discipline of their choice, or across multiple disciplines. They complete the program with a 3 credit capstone-applied project that is intended not merely as an academic exercise, but as a tool to develop practical uses of technology in the public interest.

#### Four core courses

- PIT 501 **Principles of Public Interest Technology** - introduces students to the fundamentals of PIT. Students identify and analyze stakeholders, value chains, societal dimensions, and legal and policy issues in the context of emerging technologies such as smart cities, the Internet of Things, robotics and autonomous systems, and artificial intelligence.
- PIT 502 **Co-Designing the Future** - explores how the use and processing of new technologies is changing how we interact and work. Through practical work and a mentorship program, students design and implement solutions to address public interest problems.
- PIT 503 **Technology Assessment** - trains students to evaluate a technology assessment – a systematic effort to anticipate and understand the impact of a technology.
- PIT 504 **Public Engagement Strategies** - teaches students the concepts, tools, institutions, and strategies to appropriately and effectively engage with stakeholders, including scientific and technical experts, policymakers, advocates for responsible research and innovation, and those who will be affected by technology.

#### Electives (15 credits)

Electives give the flexibility for students to explore and find a niche. Students can select courses from across the entire university’s online offerings, including: engineering, computing, information technology, data science, and cybersecurity, as well as sustainability, public service, journalism, social justice, interdisciplinary arts and sciences, health solutions, social sciences, psychology, or future and innovation studies. Internships, independent studies, and research-service-learning electives can take the place of some formal coursework.

#### Capstone project

Students must complete the applied project capstone before graduation. Students choose a specific challenge, ideally with a primary client, and choose one of several formats to present their findings: consultation, assessment, sociotechnical solution, creative piece, or something else that they design.

#### History of program

The MS PIT was suggested as a degree in 2018 by David Guston, then the SFIS Director. A group of faculty consulted across the university to design the program. Director Guston tapped Professor Katina Michael to lead the program, and she secured the requisite approvals to authorize the degree. The first 7 students began in Fall 2020. By Spring 2022, one student had graduated, and 24 students were enrolled from diverse backgrounds and professions. Most students are currently employed in the tech sector, in nonprofits, or in academic institutions. Their interests in PIT include gender violence, wildlife protection, space and ocean garbage, threats to privacy, the implications of augmented reality, and the travails of the “metaverse.”

#### Justice, Equity, Diversity and Inclusion (JEDI)

Professor Michael says PIT needs to empower those who are disempowered, using technology and design to protect, rather than threaten, the values of care and justice. PIT aims to ensure that one of the most powerful forces shaping the future - technology - is used to further, instead of thwart, the collective good. Values-based principles such as human rights, social justice, sustainability, and environmental justice should be embedded in the design, development, and deployment of new technologies. MS PIT trains students to work in diverse fields as technologists, with a keen eye to promoting the interests of various stakeholders through participatory methods that build public consensus.

MS PIT generates scholarship and builds expertise for public interest technologists who are not just technology-savvy but who are able to recognize that technology is often not well-designed to advance the public interest or address issues of equity and justice. The program is designed to expand students’ background and skill set, exposing them to ideas and methods from diverse disciplines and professions. It is both interdisciplinary and transdisciplinary, regardless of an individual student’s background, centered on solving problems rather than cultivating particular disciplinary methods.

At ASU diversity involves addressing unequal power dynamics among different groups including: race, ethnicity, religion, country of origin, sexual orientation, socioeconomic background, age, education, cultural identity, intellectual perspective, physical and mental abilities, and veteran experience. The MS PIT program addresses these issues head-on. SFIS, the academic unit housing MS PIT, is part of ASU’s College of Global Futures (CGF), which is committed to embedding JEDI in all aspects of its work. CGF works with students to ensure that the courses they take, the environment they work in, and the experiences they have all reflect this commitment. In Fall 2020, two of the schools in CGF formed task forces consisting of faculty, staff, and students. These task forces assessed progress toward JEDI goals and made recommendations about needed changes. One result is the establishment of permanent JEDI committees to monitor progress, at both the school (SFIS) and college (CGF) levels. These committees review course content as well

as assess how MS PIT and other academic programs honor ASU’s commitment to inclusion and student success.

#### Community engagement

Students in MS PIT are encouraged to include community perspectives (properly consented) in their research work. Students are encouraged to think alongside end-users - not just to create products for them but to include them in various aspects of the project so that it is truly co-designed and participatory. The core courses teach this community engagement with the expectation that students put it into practice in their applied projects.

#### Outputs and outcomes

MS PIT aims to create a new type of technology expert, one who can navigate both the technological world, but who are also able to have a

finger on the pulse of underserved communities - assessing what they may need and acquiring the tools to work with them.

#### Limitations of the program

Like many new programs, MS PIT lacks sufficient funds (through ASU resources, or private or government support) to offer scholarships, and, given the novelty of the field, there are few well-connected pathways toward employment. Scholarship funds are particularly important to ensure that the program can attract and support students from underserved communities and people of color. Philanthropic resources would be immensely helpful in filling this gap. More advocacy and awareness-building is needed to ensure that governments, companies, and non-profit organizations see the value of identifying students with PIT training appropriate to fill jobs within their organizations.

## 2. InnovationSpace

**College:** Herberger Institute for Design and Arts  
**Department/School:** School of Design  
**Director of Program:** Craig Hedges  
**Email:** cahedges@asu.edu  
**Website:** <https://design.asu.edu/innovationspace>

#### How the program fits the learning theme

Students need to be better equipped with such 21st century skills as problem solving, communication, and digital literacy in order to tackle sociotechnical issues and solve real world challenges as the future unfolds. InnovationSpace gives students the opportunity to problem solve on real challenges, by working in cross-functional, interdisciplinary teams to create entrepreneurial deliverables.

#### Program description

InnovationSpace is an interdisciplinary curriculum that brings together seven different organizations across ASU: the Herberger Institute for Design and the Arts, the Ira A. Fulton Schools of Engineering, the W. P. Carey School of Business, the Global Futures Laboratory, the Mary Lou Fulton Teachers College, the School for the Future of Innovation in Society, and the J. Orin Edson Entrepreneurship + Innovation Institute. Spanning either one or two sequential semesters, InnovationSpace enables students to develop new ways of thinking and collaborating. It facilitates innovation among fellow students, faculty, businesses, and society, while developing new products, services, and systems.

Program Director Craig Hedges, who is a brand strategist/visual communicator, says InnovationSpace addresses four needs by creating product designs that follow the “integrated innovation” model:

- Human-centered design: Inspired by the IDEO model, individuals are centered to ensure that the end-user’s needs are met.
- Beneficial to business: The innovations and products developed by students also need to benefit the business or entity they are collaborating with, advancing their agenda, too.
- Sustainable in their business model and leveraging technology and engineering: Students are taught by engineering and sustainability



experts, since their designs and products need to leverage the latest in technological innovations.

- Designed to create benefits to society: Benefiting society as a whole is central to the program. The program is in its third iteration, says Hedges, while it is designed to meet the educational needs of students, it is also intended to address the design needs of industry and community partners.

#### Program details

Students may join InnovationSpace for one or two semesters. The first semester consists of the research phase, and the second semester consists of the ideation of the innovation and its presentation to the corporate partner or stakeholder. In greater detail, the program has 6 phases:

- Team building: Interdisciplinary teams are created and different activities are set up to generate a good working environment for the teams.
- Immersion and analysis: Students are guided through a rigorous research process both in primary research through interviews and site visits, as well secondary research through articles, books, and websites. The material is then thoroughly analyzed to understand the context for the prospective innovations.

- Brainstorming and ideation: Students are coached through the Design Thinking process that enables them to generate as many ideas as possible.
- Implementation and marketing plan: To ensure that the ideas generated are applicable and feasible, a marketing and business plan is developed.
- Prototyping and testing. Students are coached in prototyping their suggested solution, which is presented along with the complete business and marketing plan.
- Proposal and final presentation. Students present their proposals in a formal setting to either a corporate client or a given stakeholder, depending on the nature of the project.



#### Program history

InnovationSpace has gone through several manifestations since its creation in 2006. The program was initially offered only in a two-semester format, and students initially came from only three disciplines - design, engineering, and business (with sustainability added later) - with contributing faculty from those same disciplines.

Today, the program is more flexible, ensuring it has a broader reach within the university and can attract students from even more disciplines, in addition to providing students with the one- or two-semester options. An example of a past project was the design of healing environments for the firm Herman Miller, but now InnovationSpace has clients who are not restricted to corporate stakeholders. They include other entities that are keen for students to address their challenge, such as museums, the police, and others – thus making InnovationSpace still more oriented toward the public interest.

#### Justice, Equity, Diversity and Inclusion (JEDI)

The program attracts students from increasingly diverse disciplines and academic units. Part of the JEDI agenda in InnovationSpace is seeking projects and partners that are diverse and serve the community in different ways. In the latest iteration, InnovationSpace is working on a project in South Phoenix to tackle the issue of air quality, which disproportionately negatively impacts lower-income communities.

#### Community engagement

The “integrated innovation” model employed by InnovationSpace is a user-centered design process, a form of co-creation that is one of the

pillars of public interest technology. The research the students perform reflects this user-centric approach. For example, with the Herman Miller project, the students’ interviewed nurses as they were delivering care at hospitals, enabling them to identify the challenges in their work in real time. Another example of a community-serving element in a corporate project is designing for CISCO a more connected Internet of Things to better assist people with disabilities. In recent years, challenges have stemmed either from direct community partnerships or through student research. Two of the most recent challenges were tackling policing issues that need to be more inclusive of community needs and creating more equitable spaces that address air quality in the greater Phoenix area.

#### Outputs and outcomes

InnovationSpace has trained more than 600 students over 15 years to work in teams to explore how a product can go from conception to market and thus solve real world challenges within the parameters set by clients. This process has given students a competitive advantage over others, especially in getting jobs. InnovationSpace director Hedges mentioned that many students really appreciate how the program adds to their career. Robin Parmentier, a graduate engineering student said, “I was asked in a job interview - a multi-part interview - some business-related questions and had I not had the experience of InnovationSpace, I would not have been able to answer any of them - I wouldn’t have been able to give the example I did, the really cool InnovationSpace project I worked on for an entire year with other people - a business major, including marketing, and that was really, really good for me, a beautiful thing.”

InnovationSpace has partnered with many large companies over the years, including Honeywell, CISCO, Johnson & Johnson, and Herman Miller. Students who completed InnovationSpace were given opportunities to intern or find a career in some of the companies they worked with. “We need employees who can work well in teams, problem solve, innovate, and then communicate their ideas” (Kristen Banks Managing Director, Accenture).

#### Limitations of the program

InnovationSpace is a long-standing program, but there are a number of limitations including the need to find funding for such complex projects, to secure the logistics to support this complexity, and to increase outreach to students across the university. Many funding opportunities that have supported individual projects were linked to faculty champions who were able to secure partnerships with certain corporations; if these faculty members no longer participated, then these partnerships no longer existed. At the moment, InnovationSpace is attempting to diversify its funding options.

Operating an interdisciplinary program within a large state university that is set up in siloed administrative spaces makes logistics particularly difficult. For example, allowing students from different schools to register for the course requires setting up essentially four different course names, one for each school - engineering, business, design and sustainability. Finally, getting the word out to have enough enrollment from each school is difficult, and some semesters will be heavier on the engineers and others on the designers. The program has adapted to this challenge by allowing the option between one or two semesters, but recruitment remains difficult.

## Case Study

# Scholarship

**PIT scholarship, research, and innovation can place institutions at the forefront of emerging technologies that serve the public good. PIT research covers broad and interdisciplinary perspectives, from making technologies accessible, to understanding and designing ethics and policy approaches to ensure the justice and equity of the technologies produced. Technologies exist everywhere - in our homes, our workplaces, our cities, and of course in the devices we use to shape how we interact with the world around us. Emerging technologies include artificial intelligence, gene editing, smart cities, and other areas where stakes are high, outcomes are uncertain, and in which novelty is contested. Such areas warrant discussions to contextualize them with the public interest and public good in mind. The development of these technologies should also address societal challenges, being cognizant of their specific ethics, impacts, implications, and long-term social and political consequences.**

## 3. The Center on Narrative, Disinformation, and Strategic Influence

**Initiative:** Global Security Initiative  
**Department/School:** Knowledge Enterprise  
**Director of Program:** Dr. Scott W. Ruston  
**Email:** Scott.Ruston@asu.edu  
**Website:** <https://globalsecurity.asu.edu/narrative-disinformation-and-strategic-influence>

#### How the program fits the scholarship theme

We live in an ever more complex world characterized by borderless domains and dangerous problems. One such borderless domain is the information environment, in which adversaries with malicious intent use disinformation and propaganda to disingenuously shape public opinion, erode socio-political institutions, and assault political will. They do so by manipulating text, images, videos, audio, or other content to obscure facts and alter context. In this world it is thus necessary to find science and technology solutions that enable us to navigate the truth in the face of entities intentionally trying to create disinformation, while still preserving the principle of free speech. These concerns are the focus of the Center on Narrative, Disinformation, and Strategic Influence (NDSI).

#### Program description

NDSI focuses on the topic of disinformation, which Dr. Scott Ruston, the Director, defines as “false or misleading or inaccurate information spread with the willful intent to deceive or do harm.” NDSI fuses humanities and social science research with state-of-the-art computer science and modeling to better understand how people make sense of the world around them, thereby supporting efforts to safeguard the United States, its allies, and democratic principles against harmful influences.

The center is a unit of the Global Security Initiative (GSI), a university-wide hub for defense and security research and programming that develops practical mission-relevant approaches and effective decision-oriented tools for

policymakers and implementers. NSDI conducts research specifically by integrating the fields of communication, data analytics, narrative, computer science, psychology, and international relations, among others, in order to study the information environment and characterize how it is leveraged for strategic interest by nation states. For example, NSDI works to create technologies that can identify and decipher the malicious manipulations taking place through synthetically generated images.

#### Program details

While disinformation in the digital domain is pernicious and now operates at an unprecedented speed and scale, it is also able to be detected and combatted. The research conducted at NDSI ranges from the development of concepts, theories and methods, to case study analysis, to the creation of tools and technologies. The tools and technologies are intended to augment the capability of security agencies, educators, journalists, civil society organizations, and ultimately citizens at large, to recognize and make sense of and counter (if necessary) disinformation.

One example of these disinformation threats to society is the automated manipulation of media artifacts - known colloquially as "deep fakes." This form of manipulated media results from emerging computational techniques to synthetically generate images, video, text, or audio largely indistinguishable by humans from genuine media. So, for example, a malicious actor could create a video in which a public figure says or does something he or she never has said or done - but it appears there is video evidence. The intent of these manipulations is deceptive in nature, to create images or manipulate text of prominent figures offering misinformation. Another case of malicious disinformation is the careful crafting of messages, memes, and other artifacts to mislead or take information out of context in order to sow discord, dismay, or confusion in an audience. These efforts may be amplified by automated scripts (e.g., "bots") manipulating social media platforms and can distort the basis upon which citizens make decisions such as allegiances, voting, and more. NDSI research contributes to technologies designed to detect and accurately describe and measure these and other types of disinformation.

#### History of program

GSI had been working on the challenge of disinformation and cultivating research capacity in the field of narrative and strategic influence since 2017; NDSI was officially launched in January 2021. GSI determines NDSI's focus areas based on national security needs and areas in which ASU has a unique capability to create impact. In this case, ASU's ability to fuse narrative theory, social sciences, and computer science research to more holistically approach the problem helps differentiate the center from its peers.

#### Justice, Equity, Diversity and Inclusion (JEDI)

Disinformation is a whole-of-society problem requiring not only responsiveness from a range of governmental and civil society organizations, but also nuanced understanding of the audiences at risk of the disinformation threats. NDSI understands that disinformation impacts communities at different levels; for example, the current ecosystem of health disinformation differs from one community to another, based on exposure, access, and other factors. Not only do the areas of audience impacts and policy solutions require nuanced understanding of communities and social structures, but also the tools and methods of research must be attentively developed to

mitigate potential biases. For example, machine learning algorithms are developed using training data (annotated data with similar characteristics to real world examples). Both the training datasets and annotations are at risk of bias based on their creation methods. To address the issue of bias in training data, the center seeks the largest amounts of data to provide breadth and depth, which is very time consuming. To address bias in annotation and labeling of training data, the center leverages social science techniques for minimizing imbalances and individual biases in the labeling process. While such work may have important implications for other areas of public interest technology, e.g., addressing algorithmic bias, NDSI puts such work directly in service of the disinformation and security frame.

#### Community engagement

While relatively new, NDSI is committed to productive community engagement, both as part of a method of operation and as a mission focus. The threats of disinformation are a whole-of-society problem, and one where the effects are not evenly manifested or distributed across different communities. NDSI has engaged with media to foster public awareness of disinformation and mitigation strategies, it leverages its analytic tools for understanding disinformation locally in Arizona, and faculty associated with NDSI have served as panelists for events and organizations of public, academic, and judicial communities of practice (such as the Arizona Supreme Court Countering Disinformation Task Force). NDSI expects that it will forge more local community connections as its work continues.

#### Outputs and outcomes

NDSI's main output is the provision of tools that can enable the US government and its allies to create safer spaces in a digital world. These tools are meant to become easily accessible to the general public. For example, the technology under development to decipher "deep fakes" eventually could become an app for mobile phones or a web browser plug-in, providing anyone the ability to see a news article or a social media post and assess the likelihood of its having been manipulated for nefarious purposes. Such an evolution from government sponsored research to everyday technology would follow a similar pattern as the Global Positioning System (GPS) or the Internet, initially developed by the Department of Defense, but now indispensable technologies used every day by the public.

#### Limitations of the program

The field is moving very fast as new information and communication technologies are developed and malign actors discover new ways to extend their surreptitious influence. Machine learning techniques are central on both ends of the manipulation-detection/defense spectrum. And in order for machine learning to be effective and ensure that it yields accurate information, it needs to be fed with a great deal of data, which puts any research at risk of encroaching on privacy issues. As technological development outpaces the norms and standards for research, data may be collected from ambiguous spaces and technologies may be encountered for which regulations still have not been established. Therefore, as it develops the research, NDSI is also shaping the ethical contours for its field. NDSI adheres to all current academic standards for privacy protection and also collaborates with ethicists to ensure the contours of this rapidly changing field are developed with attention to ethical guidelines - to ensure that it addresses whether any research trajectory should be pursued, and not only that it can be pursued.

## 4. Journal of Responsible Innovation, IEEE Transactions on Technology and Society

**College:** College of Global Futures  
**Department/School:** School for the Future of Innovation in Society  
**Director of Program:** Katina Michael; Erik Fisher  
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#### How the program fits the scholarship theme

Research in a new field needs to be disseminated, so that the field's frameworks, processes, and methodologies can be researched, presented, and debated. Public interest technology, like its cognate responsible innovation, needs academic media for dissemination. Both fields understand that technology has world-shaping powers; it is therefore paramount to create an understanding of how technology can become more responsible is fitting and necessary (Guston et al., 2014). Peer-reviewed journals give scholars the ability to share their scholarship with their academic peers, helping to establish not only the research but also the field itself. Currently, no journal entirely specific to PIT exists, but several journals publish PIT and related topics prominently, including two journals whose editors-in-chief are at ASU: the *Journal of Responsible Innovation* and *IEEE Transactions on Technology and Society*.



#### Program details

The *Journal of Responsible Innovation (JRI)* publishes research on normative assessment, practice, and governance of knowledge-based innovation. The journal attracts humanists, social scientists, policy analysts, legal scholars, natural scientists, and engineers to engage constructively and critically with issues in responsible innovation. The journal is highly curated to produce rigorous research built on strong theoretical foundations and backed up with robust methodologies. It has an impact factor of 4.034 in 2020, making it the top-ranked journal in SSCI's category of history and philosophy of science. *JRI*

attracts researchers in academia as well as industry and technology organizations. The journal has both global authors and an international readership. *JRI* accepts three kinds of written contributions: research articles of 6,000 to 10,000 words in length that communicate original theoretical or empirical investigations; perspectives of approximately 2,000 words that communicate opinions, summaries, or reviews, and articles about pedagogy.

IEEE is the world's largest technical professional organization with 440,000 members. IEEE includes several technical societies dedicated to advancing technology for the benefit of humanity. IEEE publishes *Transactions on Technology and Society*, a peer-viewed journal launched in 2020 and edited by ASU Professor Katina Michael. Professor Michael had been editor-in-chief of *IEEE Technology and Society Magazine*, the *Transactions* precursor, from 2011-2017. *Transactions on Technology and Society* publishes research papers on the interactions among technology, science, and society, on the impact of such interactions on individuals and society, and on the ethical, professional, and social responsibility of the practice of science, technology, engineering, and mathematics (STEM). Currently the journal has no impact factor, as it takes at least three years for that adjudication to take effect. *Transactions* publishes only original research of up to 10 pages (although authors can write more but will incur a \$200 charge per page).

#### History of program

*JRI* first published in 2014, with ASU Professor David Guston as the founding editor-in-chief. While it took several years to come together, according to its current editor-in-chief Professor Erik Fisher, the journal's launch was timely since it coincided with the Responsible Research and Innovation (RRI) movement in Europe. It thus became a good platform for this work to proliferate. While RRI as a frame for discussions about normative issues in science and technology had made more progress in Europe than in the US, ASU was an appropriate home for the journal because of Guston's contributions to discussions of RRI since 2002 and both Guston's and Fisher's roles in developing responsible innovation and related concepts in the Center for Nanotechnology in Society at ASU (CNS-ASU), which was funded by NSF from 2005-2016. Like the work of CNS-ASU, responsible innovation is a forerunner to and cognate concept of PIT. Using rigorous theoretical framing, *JRI* has published research specifically related to PIT, including:

- In 2014 the first issues paved the way for thinking about technology for the public interest. Articles focused on frameworks for deliberation around RI, when to consult the public to create more inclusive governance, and a conceptual framework to create clearer boundaries with criteria to evaluate RI (Wickson and Carew, 2014).
- In 2015 discussion on what constitutes publics was highlighted. Articles focused on the legitimacy of citizens' panels and other participatory activities, and an engagement with how scientists, engineers, and health professionals view the social responsibilities of their peers and their conduct (Frankel, 2015).

*Transactions on Technology and Society* launched in 2020 and published a special issue on public interest technology in 2021 (vol. 2, iss. 2). Like *JRI*, *Transactions* focuses on the importance of technology for human civilization. The first issue of *Transactions* states “that one could say that technological progress is the key ingredient driving human civilization” (Michael et al., 2020, p. 2). In addition to questions of responsible innovation, *Transactions* also asks questions of where we are going with specific technologies and what might the futures they participate in creating look like.

The special issue, focusing on sociotechnical design for PIT, attempts to answer the question, “How does innovation solve for the public interest, and the wellbeing and welfare of society, rather than a private individual or a company’s interest?” Specifically, the issue asks questions of how political and human rights can be protected in the face of emerging technologies such as AI and social media. The issue also addresses questions of common pool management, the importance of values, optimization, consensus, and failure in mitigating the harms presented by new technologies, and community-oriented PIT facilitated by blockchain where “time” is banked toward the exchange of services and skills in a community system based on reciprocity.



### Justice, Equity, Diversity and Inclusion (JEDI)

Both journals have open access options that allow content, and in particular peer-reviewed articles, to be made accessible to people without paying subscription or other fees. This version of open access enables a wider range of readers to access articles, instead placing the burden of cost on the author(s) or on their institutions. Costs for publishing open access with *JRI* are approximately \$1,500 for research articles and \$600 for other pieces (except for reviews and editorials, for which there are no charges). Substantial waivers are available for authors in developing nations, as are discretionary waivers for select authors. *Transactions’* publishing costs range from \$1,750 to \$2,995, depending on the type of article.

According to *JRI* editor-in-chief Erik Fisher, to be more inclusive, *JRI* goes the extra mile to coach and support authors who have good concepts but who may not have written a manuscript with this level of required rigor.

### Outputs and outcomes

*JRI* has published 3 issues each year since 2014, and has 96,000 annual downloads. Its narrative around RI has been articulated, strengthened, and critiqued, and the journal has shaped the narrative around RI both in the US and Europe. It has also produced scholarship that began the narrative around public interest technology. *IEEE Transactions on Technology and Society* has published 4 issues per year along with 2 special issues since 2020. The IEEE audience includes both IEEE members and non-members, both of which audiences cross many disciplinary and professional boundaries, from engineering to natural science to ethics, public policy, law, health and economics.

### Limitations of the program

*JRI* has editors that steer manuscripts through a rigorous process, accepting approximately 1/4 of submitted manuscripts for publication. The journal tries to encourage authors to resubmit by offering mentorship and editing support to bring the manuscript up to par to the rigorous standard of the journal.

As noted above, *IEEE Transactions on Technology and Society* currently lacks an impact factor, but it will be eligible for one at the beginning of 2024. A journal is eligible for an impact factor after it has published a minimum of 24 peer reviewed articles for three consecutive years.



**PIT engagement and collaboration means advancing public values that serve the community by working in close collaboration with that community. Such PIT work ideally can develop activities that improve quality of life while simultaneously cultivating knowledge and scholarship. Institutions should take responsibility for the social, economic, and cultural health of the communities that they serve. Building extensive networks between the institution and the community will intensify engagement with PIT and will help institutional actors understand how to define public interest or public values in specific circumstances. Institutions can collaborate at multiple levels of organization, and engagements can be driven either by the various communities or the institution itself.**

## 5. 33 Buckets

**College:** Ira A. Fulton Schools of Engineering/ Non-profit  
**Department/School:** Engineering Projects in Community Service  
**Director of Program:** Daniel Hoop  
**Email:** daniel@33buckets.org  
**Website:** <https://www.33buckets.org>

### How the program fits the engagement and collaboration theme

The work of PIT needs to extend beyond the walls of the university, serve the community, and improve quality of life to have real impact. Students in Engineering Projects in Community Service (EPICS) advanced exactly this kind of work and consequently established a trial project that became the non-profit, 33 Buckets.

### Program description

33 Buckets was born out of the work of three students in the EPICS program: Co-founders and board members Mark Huerta, Paul Strong, and Swaroon Sridhar aimed at empowering communities through access to clean water. The registered non-profit organization focuses on accessible water treatment choices as well as water-related education. Initially, the projects began in Bangladesh and the Dominican Republic, but they are now focused in Latin American, specifically in Peru. The design for accessible water treatment revolves around a simple, chlorine-based cleaning technology. However, all projects prior to 2018 were focused on filtration units. In Bangladesh, they implemented an arsenic filter that 33 Buckets designed within the EPICS program. In the Dominican Republic

and the first Peru project, they implemented a filtration unit called the SkyHydrant for the local community schools. Since then, they have pivoted toward chlorination systems.

### Program details

Over the course of 5-6 years, 33 Buckets has attuned its activity more toward local needs. Each project begins by identifying local community partners - non-governmental organizations (NGOs), municipalities, or private companies - that understand the unique, local needs. The second step is to practice human-centered design and tailor solutions that are based on those specific needs discovered in the first step. Finally, 33 Buckets works to establish long-term change through various education programs using the water, sanitation, and hygiene education program (WASH). These educational programs are established to train local community leaders who will work toward both the sustainability of the innovation and the opportunity for their people to exit the poverty trap.

### History of program

In 2010, students at EPICS were approached by Enamul Hoque, the founder of the Rahima Hoque Girls' College in rural Bangladesh, to support them in providing clean drinking water to his school. After some initial field visits, the team developed a sustainable clean water solution in 2014. In 2015, the team created a Water Committee and installed a filtration system in partnership with the Green Dot Corporation in Dhaka. This initial success was the impetus to pursue this work and why co-founders Mark Huerta, Paul Strong, Swaroon Sridhar, and Vid Micevic incorporated 33 Buckets as a non-profit in 2015.

The first project was a simple bucket filter used to eliminate arsenic contamination. In the second, third, and fourth projects a technology from Singapore known as SkyHydrant was used. Since they aimed at empowering communities, and the product didn't use local materials and had large upfront costs, they pivoted to focusing on more accessible and affordable systems. This switch meant the team needed to find systems that cost less and were easily set up, hence why they chose to move to chlorine-based systems that are cheap and effective at eliminating most bacteria and viruses, for Occopata and Mayrasco, Peru.

Since 2015, 33 Buckets has collaborated with two partners in Latin America: Schools for Sustainability in the Dominican Republic and The Green Program in Huilcapata, Peru. The project in Peru built strategic partnerships that enabled the program to expand its reach. By Summer 2017, the 33 Buckets team assessed the water situation of seven communities near the cities of Cusco, Trujillo, and Chimbote in Peru. Subsequently, two water franchises were opened in 2018 near Cusco, bringing clean water to 2000 people.

### Justice, Equity, Diversity and Inclusion (JEDI)

The focus of 33 Buckets is working with underserved communities where there is limited access to water filtration systems, and where local communities are experiencing illnesses due to the consumption of dirty drinking water. Their service is therefore geared to developing and deploying technology that would otherwise not exist. They also hire a diverse team. While there is only one full time employee, they have 4-5 professional consultants, including one from Peru, and 8-9 rotating ASU interns.

### Community engagement

The main way that 33 Buckets engages with communities is through leveraging relations with local partners. Currently, they are partnering with the Sustainable Development Studies in Peru (founded by a group of Peruvians who work at Universidad San Ignacio de Loyola). They aim to hire a full-time staff member in the coming year. From this ground work, 33 Buckets has identified 9 communities in the Ccorca District of the Cusco Province of Peru, and they are working with the mayor and local government leaders to create a strategic plan to improve the quality of potable water and access to it.

33 Buckets aims to involve students beyond the EPICS program, and they are also working to attract other universities.

### Outputs and outcomes

Since 2010, 33 Buckets has focused on improving access to potable water in underserved communities in the Global South. Their target outcome is to provide underserved communities with easily accessible know-how and technology that can enable them to have safe drinking water. To date, 33 Buckets has partnered with 15 communities in three countries to improve access to clean water and promote sanitation and hygiene, and in so doing brought clean water to over 7500 people. In each of these communities they implemented the WASH-based educational curriculum.

In 2020 during the COVID-19 pandemic, 33 Buckets distributed 1150 sanitation kits and implemented eight educational seminars in the Cusco region of Peru. During this period, 33 Buckets also began researching how to close the cycle for water treatment. Furthermore, they are developing an automated, real-time, and closed loop system for the chlorination process. The chlorination technology is installed, and a simple low-tech sensor detects discrepancies in the amount of chemicals and automatically adds what is needed to ensure the water is at the optimal level.

### Limitations of the program

Funding is the biggest impediment to the sustainable success of 33 Buckets. In particular:

- The project has essentially one full-time employee, its director, who is an engineer and not a fundraiser. The director is spread thin, since he has multiple tasks of marketing, fundraising, research and development, as well as implementing the projects on the ground.
- Second, although they do hire Spanish speaking consultants and interns, many of the local communities have their local dialects, for example, in Cusco they speak Quechua, which makes communication harder.
- Third, since 33 Buckets is interested in closing the technology loop to make the current water filtration self-sufficient, they need researchers who are on the ground and working with the local community to create something that is locally attuned. Such effort is a challenge financially, but also with the current pandemic - operationally, as travel has been restricted.

Most of the funds for 33 Buckets come from donations by two or three philanthropic families, with the remaining money coming from fundraising events, such as the Art-for-Agua Auction, which auctioned the art of 25 artists. 33 Buckets has begun exploring larger grants from USAID that focus on development and innovation.

## 6. SolarSPELL

**College:** College of Global Futures/Ira A. Fulton Schools of Engineering

**Department/School:** School for the Future of Innovation in Society and The Polytechnic School

**Director of Program:** Laura Hosman

**Email:** laura.hosman@asu.edu

**Director of Program:** Bruce Baikie

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**Website:** <https://solarspell.org>

### How the program fits the engagement and collaboration theme

Access to quality information and education is difficult in resource-constrained locations due to a variety of barriers, including unreliable or non-existent access to electricity and the Internet. More than half the world's population has no Internet access, and yet, even with access, connectivity can be expensive, paid for by the byte, and achieved only on a phone. Under these circumstances, first-time technology users often lack opportunities to develop information literacy and digital skills. Without such skills, locating quality, relevant educational content can be overwhelming, especially when searching the vast amount of online information for resources. SolarSPELL provides localized content and opportunities for users to learn how to find, evaluate, and use information via offline, solar-powered digital libraries that prepare users for the empowering use of the Internet when it reaches them.



### Program description

The SolarSPELL (Solar Powered Educational Learning Library) initiative combines curated digital libraries, solar-powered, offline technology, and the training to build information literacy and Internet-ready skills in offline environments, focusing on the half of the world that remains unconnected.

SolarSPELL's solar-powered, offline technology is rugged and ultra-portable so that it can go anywhere and reach anyone, even the most remote. The SolarSPELL digital library mimics an online experience by generating its own offline WiFi hotspot, to which any WiFi-capable device (smartphone, tablet, laptop) can connect and freely and safely surf the library's thousands of open access resources that are carefully curated and continually improved to meet local information needs.

SolarSPELL's digital library collections currently span primary and secondary education, health, agriculture, and the environment. Using a train-the-trainer model and working with in-field partners like Peace Corps and The United Nations High Commissioner for Refugees (UNHCR), the SolarSPELL libraries are paired with locally based trainers for long-term support.

### Program details

By always working with in-field partners like Peace Corps, UNHCR, and government ministries, SolarSPELL's holistic approach pairs each digital library with locally-based trainers for ongoing training and support. Using a train-the-trainer model, networks of locals and in-field partners are trained to leverage SolarSPELL digital libraries in their communities and build information literacy and digital skills among library users. The SolarSPELL team then conducts ongoing monitoring and impact evaluation to drive improvements based on user feedback and content requests.

SolarSPELL prioritizes using open access content and engages with content providers to source the majority of library content. SolarSPELL's digital library collections currently span primary and secondary education, health (including collections specific to nursing, midwifery, and biomedical technology) and agriculture - always aimed at meeting local information needs and reflecting the culture, geographic region, and national priorities of implementation sites via collaboration with government ministries.

The library content and software for each collection is carefully curated and contributed to by ASU students, staff, and faculty, while the hardware is assembled by volunteers at Build Days held each semester. And as information needs no limits, the initiative continues to develop new library collections focused on new topics and languages. Today there are 395 SolarSPELL digital libraries in Marshall Islands, Fiji, Vanuatu, Samoa, Tonga, the Federated States of Micronesia, Rwanda, South Sudan, and Comoros.

### History of program

Beginning in 2010, Dr. Laura Hosman, SolarSPELL Co-Founder and Director, and faculty at ASU, traveled to remote, rural schools across the Caribbean, West Africa, and the Pacific Islands. In each location, she found that teachers and students in these schools, often lacking Internet connectivity and electricity, were in need of both an education-focused technology, as well as training on how

to utilize such resources to transform teaching and learning. After various innovations and prototypes, Dr. Hosman, along with her students, designed a solar powered, offline, portable, rugged digital library containing localized educational content, known today as SolarSPELL.

The future for SolarSPELL includes creating a more accessible user interface as well as working with the design team to speed production given the demand. SolarSPELL continues to expand implementation to new contexts, countries, and regions, including new projects in refugee camps, Latin America, the Middle East, and Sub-Saharan Africa.

### Justice, Equity, Diversity and Inclusion (JEDI)

SolarSPELL's work is simultaneously focused on improving educational opportunities for students around the world, as well as at ASU. In this way, SolarSPELL libraries are created for learners by learners. All collections include resources on sustainability, gender equity and inclusion, and digital and information literacy. Every semester the SolarSPELL initiative at ASU engages 60-75 university-level students from classes, capstones, or internships to contribute to all aspects of SolarSPELL's work. The SolarSPELL initiative provides students opportunities to engage globally, behave entrepreneurially, carry out real-world work with purpose and impact, and transform society.

### Community engagement

SolarSPELL prioritizes relationships within the ASU community and across the global communities with which ASU works. In order to better understand the local context in which the libraries are implemented, the team is continuously learning and conducting impact evaluation to improve all aspects of the initiative. The SolarSPELL team focuses on meaningful interactions with people to deliver products and services of value to them, often working across disciplines to integrate diverse knowledge and perspectives. This style of work also means collaborations with organizations such as Khan Academy, TEDx, Wikimedia Foundation, UNESCO, World Health Organization, and others.

### Outputs and outcomes

As part of implementing SolarSPELL digital libraries in-the-field, the SolarSPELL team conducts ongoing monitoring and impact evaluation. Through tools such as usage tracking software, surveys, and interviews, the team gathers feedback from library users and in-field partners. Learning from such monitoring and evaluation informs data-driven change and facilitates on-going improvements to the libraries, hardware, software, training workshops, and implementation.

To date, the SolarSPELL initiative has implemented 395 digital libraries in 9 countries (South Sudan, Rwanda, Comoros, Fiji, Samoa, Tonga, Vanuatu, Marshall Islands, Micronesia) and trained 645 in-field trainers, reaching 96,497 learners. Once trained, 95% of survey participants felt comfortable using the SolarSPELL library, and 85% felt comfortable training others. Furthermore, more than 90% of users interviewed felt better equipped to use other forms of technology, including the Internet, from their SolarSPELL experience.

SolarSPELL is an invaluable resource to communities. Examples include benefits both for teachers, who become more confident in their teaching abilities and who are thrilled at going from chalkboards

and limited textbooks to having access to supplementary, interactive educational materials for the first time, and benefits for students, who can see significant increases in test scores (Hosman et al., 2020). An 8th grade teacher in Fiji reported: "Three years ago, my 8th graders scored 29% on their exit exam. The next year, we moved it up to 54%. But last year, with access to the SolarSPELL, they got 100%" (Hosman et al., 2020).

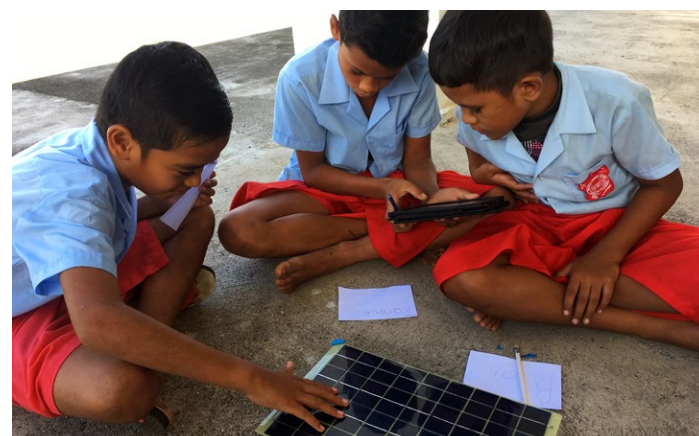
Impact has even continued during the COVID-19 pandemic. In South Sudan, parents and teachers downloaded 10,000+ textbooks from SolarSPELL libraries, giving students access to crucial learning materials alongside radio lessons. In Fiji, with schools closed, teachers are using the libraries to enable out-of-school learning, downloading assignments for students to complete at home.

There are currently 6 digital library collections in various fields, including health and nursing, and the SolarSPELL team continues to develop more each year. The initiative also supports student learning and engagement. In 2020, 100 graduate and undergraduate students from 6 universities across the US engaged in SolarSPELL activities. Furthermore, the initiative manages the metadata, that is, the information about the information gathered, for all library collections. Undergraduate and graduate students do the meticulous work of managing the metadata of the resources curated for SolarSPELL's offline digital libraries.

### Limitations of the program

Because SolarSPELL's approach goes beyond the provision of a technology, the ruggedized hardware comprises a small fraction of the overall cost of an implementation. A greater proportion of the cost comes from the time and effort it takes to create, localize, and fully curate the libraries, as well as carry out the training, measurement, and impact evaluation.

The COVID-19 pandemic presented challenges to conducting standard in-person field visits in 2020 and 2021, but the SolarSPELL team used these delays as an opportunity to launch other initiatives, such as preparing an offline, digital version of the training program. This offline training course allows the team to train SolarSPELL trainers and new users from anywhere around the world, enabling them to continue to support the education of remote, rural learners while travel is not possible, as well as supporting rapid expansion as SolarSPELL scales.



## Case Study JEDI

**Public interest technology JEDI means centering and advancing Justice, Equity, Diversity, and Inclusion efforts pertaining to PIT activities across the university. By justice, we mean dismantling barriers to resources and opportunities in institutions, so that students, faculty, staff, and the community at large can live a full and dignified life of learning. By equity, we mean allocating resources to ensure that everyone has equal access to these opportunities from an institutional perspective. By diversity we mean removing barriers to ensure equal opportunities across race, gender, class, religion, disability, LGBTQ+ identity, and other potential differences and, more, acknowledging and celebrating such differences. By inclusion we mean amplifying the voices and perspectives of those who experience more obstacles due to their identities. JEDI can be enhanced across these four other categories of PIT by creating a culture of reciprocity to ensure the public good.**

## 7. Center for Gender Equity in Science and Technology

**College:** The College of Liberal Arts and Sciences  
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**Director of Program:** Kimberly Scott  
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**Director of Program:** Sandy Martinez  
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**Assistant Research Professor:** Tara Nrumah  
**Email:** Tara.Nkrumah@asu.edu  
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### How the program fits the JEDI theme

To ensure that more women and girls of color have equitable access to science, technology, engineering and math (STEM) fields, diverse opportunities must be offered to them, while people in those fields must understand the barriers limiting their access and success. Coordinated interdisciplinary research and evidence-based strategies are lacking, especially research that takes into account the identities of girls and subsequently their potential to impact the field. The efforts of the Center for Gender Equity in Science and Technology (CGEST) have focused on bridging this divide.

### Program description

CGEST aims to create a racially and ethnically diverse and interdisciplinary community of scholars, students,



policy makers, and practitioners who explore, identify, and ultimately create innovative scholarship about and best practices for under-represented girls in STEM. Focusing on women of color (African American, Native American, Latina, and Asian American), CGEST has developed approaches in research, capacity building, and advocacy. Dr. Kimberly Scott, CGEST Director, says, "It is more than simply filling the STEM pipeline with more girls and women of color. It's creating an environment in which that happens naturally."

### Research

CGEST conducts research to identify better ways of asking questions of women of color in STEM, in order to develop culturally responsible instruments (such as surveys) and programs to include more diversity. The center strives to address the systemic issues that have kept under-represented women and girls from STEM by critiquing the existing body of research, generating new research, discussing it with the local community, and offering culturally responsive STEM education programs that synthesize what has been learned. Dr. Scott provides the example of how, when developing survey questions for understanding the challenges faced by girls in STEM, CGEST included in its process native Hawaiian and Hawaiian residents, who helped refine the questions with suggestions from their own experiences. CGEST can then further develop programs through its capacity-building arm. CGEST disseminates its research by different means, including policy briefs such as the ones developed for the Women of Color Computing Collaborative, which aimed at increasing the number of women and girls of color pursuing and completing computer science degrees.

### Capacity Building

Creating programs that strengthen the skills and abilities of girls



and women to work in STEM fields is the aim of CGEST's work. A central project of this effort has been CompuGirls, which began in 2007, prior to the establishment of the center. CompuGirls brings together new cohorts of students each year and exposes them to an array of technologies to become "technosocial change agents." The technologies they are exposed to range from filmmaking to GIS (geographic information systems) to cybersecurity, and students are taught to use them within the context of improving their own communities. According to Dr. Scott, "there are programs in professional development for teachers, including summer programs, school programs, and college programs that include nurturing male allies, and that range from Hawaii all the way to Ireland."

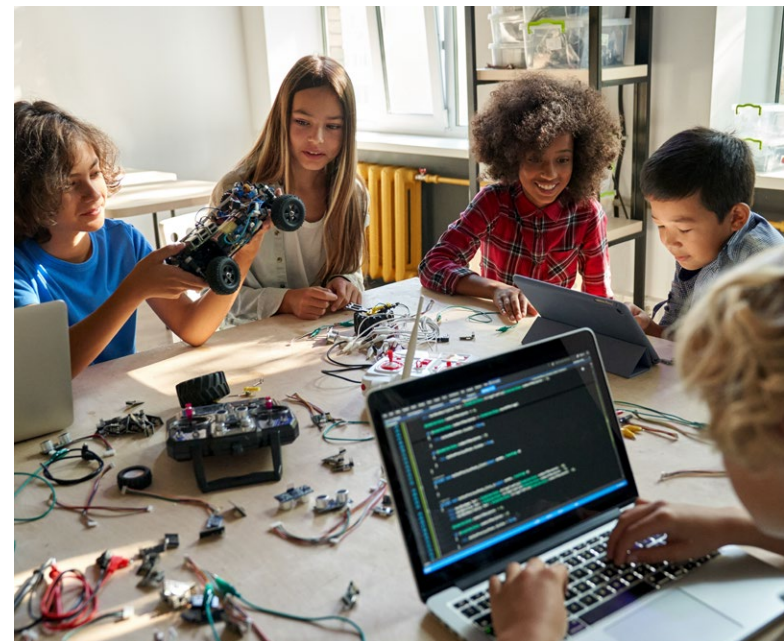
### Advocacy

CGEST compiles the lessons learned from the research and capacity building and disseminates them to policy makers at various levels of government, including the K-12 school district level and state and federal agencies. "The advocacy arm puts on programming that is attempting to make sure that our lessons learned from our other two arms are not only accessible, but also attainable," says Dr. Scott. The information is also compiled in a format that is accessible to decision makers - a digital repository of best practices: (<https://cgest.asu.edu/advocacy/digitalrepository>).

### Program details

CGEST runs a variety of programs with underrepresented students in schools and communities, including CompuGirls, CompuPower, and Learning Libraries.

CompuGirls is a culturally responsive technology program for adolescent (grades 8-12) students from under-resourced school



districts in Arizona, Colorado, New Jersey, and Wisconsin. Supported by grants from the National Science Foundation, CompuGirls provides fun after-school, summer, and year-long programs where participants learn the latest technologies in digital media, game development, and virtual worlds. The program is designed to enhance the students' technosocial and analytical skills and aid in their development and positive self-realization.

CompuPower is an in-school technology and leadership program designed for rural high schools (grades 9-12). The program provides teachers with the skills to use culturally responsive and gender-inclusive practices in their teaching of science and technology. Students who take the course use technology for research and problem solving, also developing their non-cognitive skills such as self-regulation and becoming changemakers in their communities.

The Learning Libraries program enables students aged 13-16 to develop skills to become tech innovators and community leaders. Students are provided a tool kit and supplies to discover basic technological applications. The libraries also deliver culturally responsive programming and computer science education to librarians, and then students participate in summer camps that are led by librarians at each of the program sites.

### History of program

CGEST was created in 2016 as a one-of-a-kind research unit to address the lack of women and girls, especially those belonging to diverse racial, ethnic, and social class groups, in STEM fields. The center includes different pre-existing programs and has been built on the years of experience that Director Dr. Kimberly Scott brings to the field. Her work setting up CompuGirls (in 2007) and beyond garnered her the STEM Champion of Change award by the Obama administration in 2017.

### Justice, Equity, Diversity and Inclusion (JEDI)

CGEST models its mission by walking the talk, employing diverse staff, and being intentional with whom they collaborate.

Intersectionality, that is, the interconnected nature of one's identity that could be sex, race, or socioeconomic status, is woven into the model framework and is used as a premise in the CGEST's decision making process. CGEST staff contemplates Intersectionality when making decisions related to choosing a partner with whom to work or a project in which to participate. For example, when CGEST staff discusses a project with potential partners, they will highlight the importance of centering girls and women in the process and will ensure that the work they do is collaborative, inclusive, and decolonial. If the potential partner's mission does not align with CGEST's mission and values, CGEST will refuse to collaborate with those potential partners.

### Community engagement

A key to CGEST's process is "asset building," the belief that, irrespective of economic disadvantage or disenfranchisement, everyone has assets that need to be recognized and valued. Among CGEST's values is the importance of building solid relationships with the partners, the stakeholders, and the community itself. For example, CompuGirls builds strong relationships with the students, their teachers and parents, the school principals, and even personnel at the district level.

### Outputs and outcomes

In terms of research, the center has a team of more than 50 members and has more than 40 pieces of published materials. They have published books, book chapters, policy and technical reports, refereed and non-refereed journal articles, and presentations. Thus far CGEST has secured over \$13 million in research funding. CGEST works in collaboration with partners that are small and large across 8 states, ranging from high schools such as Apache Trail High School, to the Hawai'i Tropical Bioreserve & Garden, to larger organizations like State Farm. CGEST's advocacy arm has focused on disseminating their knowledge. To ensure this knowledge is accessible and widely available, they have created an open-access digital repository on the ASU library platform called KEEP, to collect, preserve, and distribute digital material.

### Limitations of the program

One of the biggest challenges highlighted by Dr. Scott is identifying early on in its process if partnerships are being built with people and entities that uphold the same values of rejecting patriarchy and encouraging diversity. This challenge may become apparent only after collaborative work has begun. For example, one of CGEST's values is to be self-reflective and to learn and grow. But the center often discovers once the process has begun that a partner organization doesn't value self-reflection. A second challenge is securing funding, and while CGEST luckily has good sources of funding for projects and programs, few agencies will fund the operations of the center. Third, although the upcoming Gen Z students are very sensitive to issues of social justice, according to Director Dr. Scott, they are more segregated in their neighborhoods and schools. This new segregation means that extremism is also on the rise, including a rise in white supremacy, which Dr. Scott believes needs to be dismantled.

## 8. Indigenous Design Collaborative

**College:** Herberger Institute for Design and Arts  
**Department/School:** School of Design  
**Director of Program:** Wanda Dalla Costa  
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**Program Manager:** Tierra Miller  
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**Website:** <https://design.asu.edu/research-and-initiatives/indigenous-design-collaborative?dept=1626&id=1>

### How the program fits the JEDI theme

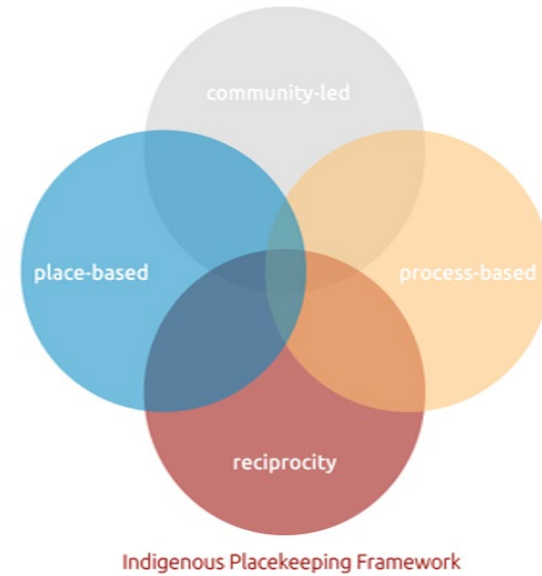
The Indigenous Design Collaborative (IDC) is trying to create diverse, inclusive, culturally appropriate, and locally attuned ways of designing our world. Indigenous design differs depending on which tribe is creating it and what it is being used for. However Indigenous design does have key characteristics and values that are shared across the numerous contexts. These intrinsic concepts that stem from Indigenous design are the reason the IDC was created and spearheaded by architect and professor Wanda Dalla Costa.

### Program description

IDC is part of both ASU's School of Design and the Del E. Webb School of Construction. It is a community-driven design and construction program, bringing together tribal community members, industry, and a multidisciplinary team of ASU students and faculty to co-design and co-develop solutions for tribal communities in Arizona. IDC projects range from tribal sustainable housing to urban Indigenous place-keeping studies. Centering on community needs and values, it prioritizes the following aspects of design: historical understanding, community-driven metrics, Indigenous design thinking, technological innovation, local vernacular intelligence, holistic systems solutions thinking, and collaboration with local practitioners.

### Program details

A program runs each semester with a new cohort to address a community-centered project. The IDC Director, Wanda Dalla Costa, developed a "Placekeeping" framework to initiate dialogue on Indigenous design pedagogy, particularly defining an approach for use-inspired work in an institutional setting. The Collaborative teaches students how to use Indigenous-led and Indigenous



approaches as applied to design. This work has been done both inside the campus, to 'Indigenize ASU campuses,' but also with external collaborators. IDC has created a declarative living document to be used and built on by scholars, practitioners, knowledge brokers, and lay experts. The process is inspired by the different Indigenous worldviews, emphasizing knowledge as a life-long journey, and changes with each project based on the tribes represented (the work builds on Dalla Costa's Cree origins and her worldview) and divided into four cycles: 1) being place-based, 2) community-led, 3) process-based, and 4) embracing reciprocity. This process has inspired various projects, including creating infrastructure that acknowledges and integrates kinship systems, as well as creating design inspired by vernacular intelligence, and developing with indigenous community's co-design methods.

### Previous projects

- **Labriola Custom Table:** a project celebrating place-based O'odham (Indigenous tribe in Arizona) basketry patterns and integrating them into a built form. The project was to customize a conference table within the Labriola National American Indian Data Center at ASU's Hayden Library, intended as a collaborative space that provokes a sense of Indigenous identity and reflects a local narrative. The project was a collaboration with a local Salt River Pima Maricopa Community metal artist Jeffrey Fulwider, who brought lived experience to the design work to share the history of this region.
- **Gila River Indian Community Sustainable House (GRIC):** a project addressing the challenge that temperatures in Arizona can reach 118 F (47 C), which increases electricity consumption by 30% and becomes a financial burden on low-income residents. The project worked with a community of 13,000 members located adjacent to the city of Phoenix to create a prototype of sustainable housing. ASU faculty and students completed multiple activities toward understanding cultural design of homes for GRIC. Activities included two community design engagement sessions, the construction of a traditional shade structure (vato) at GRIC, a survey on sustainable housing, and a mobile design lab with residents.

### History of program

The Collaborative began in 2016 and has been led by Professor Wanda Dalla Costa, a member of the Saddle Lake Cree Nation and practicing architect. Dalla Costa has been pioneering this work in Canada and now in Phoenix, through her company Tawaw Architecture collective (Tawarc.com) that has a team of Elders, knowledge brokers, cultural bearers, and artists that represent different Indigenous tribes including, Cree, Navajo, and Pascua Yaqui and specialize in co-designing with community. Tawaw began in 2010 where Dalla Costa was Canada's first First Nations woman to become a licensed architect.



### Justice, Equity, Diversity and Inclusion (JEDI)

IDC is open to all students interested in including Indigenous design methods into their design work. The premise of the Collaborative is to introduce students and the community at large to Indigenous methods, as well as to work in and collaborate with the community, especially with tribal communities. IDC is run by an Indigenous architect along with a team of mostly Indigenous students and is aiming at valuing the role of Indigenous art and design to the community at large. The program also started a scholarship program for undergraduate students to outreach to students who might be interested in more inclusive design.

IDC offers a scholarship program to support diverse narratives in the design field. The scholarships support studio or self-directed creative work by students. Tierra Miller, the program manager at IDC, says that although the scholarship is called "Indigenous design," the designs do not need to be Indigenous and the students seeking the scholarship need not be Indigenous people. However, the students seeking the scholarship should address issues of equity in architecture, spatial agency, and/or the decolonization of design.

### Community engagement

IDC aims to create more intentional community engagement and have active co-creation with the community through the design process. The level and quality of community engagement will vary according to the project, but typically IDC uses an iterative design process in which the Collaborative: a. researches place and the local context; b. engages in a series of broad engagement activities of various types with local stakeholders; c. synthesizes the engagement; d. creates

initial designs and concepts using diagrams and 3D models; and e. verifies back with the community whether they accept the design.

IDC aims to have a larger role in the public discourse and is also involved in public engagement to bring Indigenous design to the public. IDC runs a series of lectures each semester, inviting Indigenous designers and architects to expose students and faculty to a variety of Indigenous design philosophies and modalities. Through ASU's Aspire program, the collaborative has started an initiative to host high school students and interest them in architecture.

### Outputs and outcomes

IDC has thus far completed 14 projects with a different cohort of students each semester. The team currently consists of 2 members in leadership, one graduate (Program Manager Tierra Miller) and 8 students. Two scholarships have been offered since 2020. IDC aims to increase engagement with high school students to attract them to the field of architecture.

### Limitations of the program

IDC hopes to expand from a collaborative to a center that is able to run entire degree programs and a variety of other activities. At the moment, the biggest limitation is the access to funds and grants to support this specific type of work. While there is institutional support for the work they are doing, there are few resources to help take the Collaborative to the next level. For example, there is a lack of program management as well as in human resources, particularly in terms of mentors and supervisors to coach and inspire designers and architects.

## Case Study

# Operations

**Public interest technology operations provide institutional support for the development of PIT activities and incorporate PIT into institutional missions by reflecting on the role of the institution as a user and maker of technologies, creating PIT-inspired policies and procedures, and working toward PIT ideals across the full spectrum of institutional activities. Institutions of higher education have an important role as developers, procurers, and deployers of technologies, and they should thus maintain internal processes to assure that they protect the public interest. In much the same way institutions of higher education change their practices as well as their curriculum to address sustainability challenges, they should do the same with respect to PIT. Three components of operations are:**

- **Policies and procedures:** Clear institutional guidelines to support PIT through logistical, financial, operational, and other approaches, as well as metrics that might clarify and improve these approaches.
- **Procurement and deployment:** Reflexive understanding of what is appropriate to ensure the interests of the institution's community - students, faculty, and staff - are supported when the institution makes decisions involving the purchasing and deployment of new technologies and systems.
- **PIT ideals:** Clear expression of and commitment to PIT ideals across the wide array of institutional functions, working to unify the institution's interest and the public interest.

## 9. ASU Smart City Cloud Innovation Center

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### How the program fits the operations theme

Public interest technology activities should transpire across the activities of a college or university, including within the operations of its own campus, in order to walk the talk. ASU's University Technology Office (UTO) has centered this commitment not only in its daily operations, but also in projects that it endorses and supports. The Cloud Innovation Center is a great example of how a collaboration can take place among an institution of higher education, a private company such as Amazon Web Services, and civil society.

### Program description

The ASU Smart City Cloud Innovation Center (CIC) is a partnership between UTO at ASU and Amazon Web Services (AWS), which employs Amazon's innovation processes, cloud expertise, and global solution platforms to solve pressing community and regional challenges. CIC is part of a long-term collaboration between ASU and AWS to improve the digital experiences for smart city designers. It aims to do so by expanding technology alternatives while minimizing costs and facilitating the sharing of public sector solutions within the region. It is essentially about providing accessible and cheap technology to advance cities and the most underrepresented communities. For example, during the 2020 pandemic, CIC created management software to ease the distribution of CARES Act assistance money.

### Program details

The program focuses on creating smarter cities. CIC employs Amazon's "working backwards" process, which puts customers at the center of the discussion and designs solutions based on their needs. In the true spirit of public interest technology, it centers the needs of end-users, enabling community members to better navigate current digital transformations and develop free, open-source prototypes of possible approaches.

The team consists of one ASU staff member, three AWS members, and 4-8 students. The "working backwards" strategy has been created through the experience of many years of work at Amazon, through collecting data in the same way Amazon Prime collects data, and designing the service based on what the customers need and improving their user experience. The "working backwards" strategy is composed of the following steps: a. mock press release with envisioned solution, b. creating an FAQ (frequently asked questions), c. creating visuals, and d. actually engineering the final solution.

For a challenge to start, an online submission is filled in with a series of questions, from metrics CIC uses to determine which projects to on-board: <https://smartchallenges.asu.edu/submit-a-challenge>.

### Examples of challenges include

- Fall prevention for seniors, in partnership with Christian Care Fellowship Square Mesa: The bedroom smart fall prevention solution uses Amazon Alexa and WIFI-connected motion sensors to provide reminders and automation in an effort to reduce the causes of falls by elderly residents.
- Data exchange, in partnership with eThekweni municipality in South Africa: eThekweni, South Africa's third largest municipality, and the CIC have been working collaboratively since July 2020 to

understand the city's data challenges in supplying water to over three million residents spread across 900 square miles. Together, they built a dashboard for eThekweni that aggregates data from several points throughout the area, including the government-owned supplier of water for the province Umgeni Water.

### History of program

AWS is working with 12 universities globally to give back to the public sector over a period of 2 years. The program began exclusively in the Phoenix area to tackle city challenges, and as the need for this work increased, it expanded to other cities in Arizona and now it has expanded globally, including in New Mexico and Durban, South Africa.

### Justice, Equity, Diversity and Inclusion (JEDI)

Every CIC challenge is designed to tackle an issue of public interest. The challenge addresses the concerns of underserved communities that typically might not have access to various technologies. Ryan Hendrix, General Manager at CIC, says, "If you look through our website of challenges, you will see that many are related to the challenges of PIT. Ultimately they are about impact for greater good." Such projects designed to directly or indirectly benefit underserved populations include "Reducing Evictions with Assistance Delivery," "Phoenix Human Services Campus - Reducing Homelessness," "Georgia - Department of Human Service Gateway," and "Reducing Poverty with Digital Service Delivery." CIC understands that not all human challenges have technical solutions, but its aim is to utilize Amazon's "working backward" process to help the metropolitan Phoenix area solve its most pressing urban challenges.

### Community engagement

CIC is set up to serve the public good, mostly with a focus on different cities. At the moment, it operates at no cost to the client; prospective clients apply through an online process and if their project gets accepted, they would not pay for the service. The program is also set up to promote the creation of open-source solutions, meaning technological solutions that are made freely available to other entities.

### Outputs and outcomes

Since its launch in 2019, CIC has had a large impact through partnerships with cities - locally, regionally, and globally - as highlighted in examples ranging from chatbots to data exchanges. To date, 27 projects have been implemented, and have created open-source material, working in places as diverse as Phoenix, Arizona and King Abdullah University of Science and Technology (KAUST) in Thawal, Saudi Arabia.

### Limitations of the program

CIC has a relatively small team that changes with new sets of students, and it therefore has difficulty with continuity. The projects also take a long time to be completed, since the technologies developed are tailored to the needs of the client. The overall partnership with Amazon is limited to two years, and therefore CIC has a limited ability to grow and take on more ambitious activities beyond the scope of the overall partnership.

## 10. Digital Equity Initiative

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### How the program fits the operations theme

ASU's University Technology Office (UTO) has centered its commitment to PIT not only in its daily operations, but also in projects it endorses and supports. One challenge for diverse students coming from different backgrounds is the reality of unequal access to technologies such as broadband. UTO created the Digital Equity Initiative to push toward more equitable access.



### Program description

UTO is advancing a series of discussions, projects and initiatives - in partnership with local, state, and national organizations - to connect under- and un-served communities to reliable, high-speed Internet. Equipping these communities with tools, resources, and skills can move the needle in enabling them to participate meaningfully in the increasingly digital world that encompasses learning, work and social and family life.

DEI is testing and deploying new and emerging networking technologies to extend wireless Internet access into the homes of learners and families. One of the successful pilots was to use a millimeter wave and 5GHz wireless technology to extend reliable, high-speed Internet into the homes of learners in the greater Phoenix area.

### Program details

Through various conversations and conferences held with diverse partners, UTO identified and prioritized making digital access available to a wide array of members of its community. The Digital Equity Initiative has run such programs as:

- "Lighting Up the Future," which convened changemakers across Arizona to address the digital divide through four virtual roundtable discussions that advanced solutions to close gaps in the availability, adoption, and utilization of the Internet facing many communities.
- UTO partnered with the Future of Tech Commission (FTC), an independent and bipartisan group of civic leaders developing a comprehensive and inclusive tech policy agenda for the nation, to co-host a virtual Town Hall in July 2021. The event gathered cross-sector input from governors and policymakers, community leaders, civil society groups, academics, industry experts, business leaders, and entrepreneurs to help inform the nation's technology policy agenda.

### History of program

UTO created DEI in partnership with ASU's Watts College of Public Service and Community Solutions in early 2021, as well as with community partners - including the Institute for Digital Progress, Arizona Commerce Authority, and the Sun Corridor Network. The program was set up based on the identified need to bridge the digital divide.

Roughly 75,000 households in Arizona still rarely, or never, have Internet available for remote learning for students. DEI is developing sustainable and scalable solutions to address this digital divide. Community anchor institutions act as focal points for broadband access, to serve their direct constituents, as well as the communities in which they reside; and they will leverage their newfound network connectivity to not only provide basic Internet access, but also augment the kind of services they provide.

In summer 2021, the DEI team partnered with Phoenix's Isaac School District (ISD) to launch a pilot program that uses millimeter wave technology to extend the district's wireless Internet connection into the homes of its students. The pilot started at ISD's Moya Elementary, which serves students in grades K-5. At launch, the partnership successfully connected eight households living in the nearby Trailer Corral Community to the school's Internet for students to be able to complete online learning at home, with plans to connect additional schools and learners' homes across the district in the near future.

### Justice, Equity, Diversity and Inclusion (JEDI)

The project focuses directly on under- and un-served communities, targeting the unjust distribution of broadband technologies. In so doing, UTO is enabling a larger number of students from diverse backgrounds to have access to technology, which in turn gives them the possibility to access more educational and other opportunities.

### Community engagement

The partnership among UTO, the Watts College of Public Service and Community Solutions, and community partners is united under the Watts College of Public Service and Community Solutions' Maryvale One Square Mile Initiative, which supports community-driven



solutions to create sustainable change for priorities in and around Maryvale. Starting in late 2021, the One Square Mile Initiative teams began knocking on doors to tell people about the opportunity to participate in the DEI program - and to build trust and dispel doubts around the service. These efforts have continued into 2022, with ASU students and staff supporting these community engagement efforts.

### Outputs and outcomes

DEI hopes to bring Internet connections to up to 200 homes in the next year, and expand to more areas in Phoenix and Arizona in the near future, using a structure they refer to as a pyramid. At its broadest foundation, the technical facilitation of digital equity is built on network infrastructure. Reliable, high-speed Internet with the right throughput and bandwidth is the basis of digital equity. The next step up the pyramid is digital fluency; with access in people's hands, an effort has to be made to help them understand how to use the Internet and leverage it for upward economic and knowledge mobility. Finally, applications that leverage the high-speed connections and digital fluency have to be meaningful to users; software and hardware have to enable education and other important facets of everyday life.

Opportunities provided by the pyramid of access are vast, connecting the unconnected to the digital world with numerous applications, but crucial ones exist in the realms of education, healthcare and economic development. Driven by the global pandemic, much of learning exists online. Ensuring that all learners have access to high-quality learning experiences is paramount.

### Limitations of the program

Millimeter wave technology relies on line-of-sight, meaning that the antennas of the roof of the anchor institution and house must not be obstructed. In addition, millimeter wave has limited reach. So, in addition to millimeter wave, the initiative will use Citizen Broadband Radio Service (CBRS) to overlap the antenna-to-home structure of millimeter wave with the "roaming" capabilities of CBRS, similar to the LTE access available on a cell phone. Key partner Sun Corridor Network will provide the network that ASU and now these anchor institutions use.

## References

- Frankel, Mark S. 2015. "An empirical exploration of scientists' social responsibilities." *Journal of Responsible Innovation* 2(3):301-10.
- Guston, David H., et al. 2014. "Responsible innovation: Motivations for a new journal." *Journal of Responsible Innovation* 1(1):1-8.
- Hosman, Laura, et al. 2020. "SolarSPELL assessment: Impact of a solar-powered digital library as a teaching-learning resource on climate change." *Sustainability* 12(16) [DOI: 10.3390/su12166636].
- Michael, Katina, et al. 2020. "Dealing with technological trajectories: Where we have come from and where we are going." *IEEE Transactions on Technology and Society* 1(1):2-7.
- Wickson, Fern and Carew, Anna L. 2014. "Quality criteria and indicators for responsible research and innovation: Learning from transdisciplinarity." *Journal of Responsible Innovation* 1(3):254-73.

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