

# MIT D-Lab

D-Brief 2023-2024

Academics-Research-Practice

“D-Lab’s mission, to me, is the pinnacle of what MIT stands for. It’s about using our privilege, our creativity, and our intelligence to help those who are less fortunate. It’s about empathy, humility, and kindness. It’s about caring for others. But it’s also about empowering others. It’s this sort of work that makes the world a better place and pushes society forward—and doesn’t leave anyone behind.”

- Sophia Chen '24



Woman sawing CCB, Ghana, January 2024  
Photo: Courtesy MIT D-Lab



D-Lab students and community partners, India, January 2024. Photo: Courtesy MIT D-Lab

## Climate resilience, just livelihoods, and equitable systems design

Over the course of the past year, following discussion and analysis of more than two decades of work at MIT and in more than 30 countries, D-Lab identified three essential themes that organize our work. We invite you to learn about them below and read on for an overview the 2003-2024 year in D-Lab academics, research, and practice!

### CLIMATE RESILIENCY

How we define it: The capacity of individuals, communities, and systems to respond to, recover, and adapt to the impacts of climate change.

What we are doing: Strengthening the climate resiliency of low-income communities vulnerable to and directly affected by climate change. This may include designing sustainable technologies, developing renewable energy solutions, improving agricultural practices, fostering community-based adaptation initiatives, and enhancing access to resources and information to build resilience in the face of climate-related challenges.

### JUST LIVELIHOODS

How we define it: Economic and productive activities that are not only sustainable and financially viable to support a household’s needs, but are also designed to be just and equitable for all members of a community.

What we are doing: Strengthening livelihood activities that enhance the voice, choice, and power of community members, particularly for marginalized or vulnerable communities. This may include designing and implementing projects, technologies, and methodologies that promote inclusive economic growth and gender-sensitive development, while fostering dignity, agency and well-being.

### EQUITABLE SYSTEMS DESIGNS

How we define it: The intentional process of designing, implementing, and strengthening systems, structures, and interventions in a way that promotes fairness, justice, and inclusion, particularly for marginalized and vulnerable communities. .

What we are doing: Bringing together diverse stakeholders and applying participatory design methods to incorporate their perspectives, experiences, and the situated knowledge of communities in the design of programs, policies, and products that enhance their livelihoods and well-being. This may include engaging with local communities to identify social and cultural norms, conducting participatory research to understand the local ecosystem, and elevating the voices of marginalized groups in decision-making processes to create systems that foster deeper and more sustainable outcomes that benefit all members of society.

## Subjects Offered 2023-2024

D-Lab offers 12-15 full-semester classes each year. Below are the classes offered 2023-2024.

D-Lab: Development  
11.025/11.472(G)/EC.701/EC.781(G)

Introduction to Energy in  
Global Development  
2.651/EC.711/EC.791(G)

Applications of Energy in  
Global Development 2.652/  
EC.712/EC.782(G)

D-Lab: Schools - Building  
Technology Laboratory  
4.411/EC.713J

D-Lab: Water, Sanitation,  
and Hygiene  
11.474(G)/EC.715

D-Lab: Gender and  
Development  
EC.718/EC.798(G)/WGS.277

Climate Change and Planetary  
Health  
EC.719/EC.789(G)

D-Lab: Design  
2.722J/EC.720

D-Lab: Leadership in Design  
EC.725

Design for Scale  
EC.729/2.729/EC.797(G)/2.78(G)

Global Ventures  
MAS.665/15.375/EC.731J

Mobiles for Development  
EC.751/EC.786(G)

Terrascope: Design for  
Complex Environmental Issues  
2.00C/1.016J/EC.746J

Build Your Own Bicycle  
EC.S02 (IAP)

Climate Solutions and Action:  
100% Decarbonization of  
MIT's Buildings by 2035  
EC.735/795

## MIT D-LAB ACADEMICS

Under the leadership of Professor Maria Yang, D-Lab Faculty Academic Director, and D-Lab Associate Director of Academics Libby Hsu, D-Lab offered 15 subjects this past year with 200 students enrolled. Ten additional students worked closely with staff on research projects in Cambridge and abroad through MIT's Undergraduate Research Opportunities Program (UROP).

In addition to D-Lab's many popular classes, this year, we offered a new class in conjunction with a two-year program funded by the KOICA, the Korean Development Agency. The class, *Mobiles for Development*, was a great example of the way in which D-Lab brings together MIT students with longstanding community partners to address the needs of people living and working in low-resource areas. In this case, students worked with the NGO Kulika, Uganda; the Youth Social Advocacy Team, an organization of South Sudanese refugees; and Twende, a community makerspace in Tanzania. Together, students and community members worked on projects using upcycled Samsung cell phones to control and monitor the use of other devices (a crop thresher and an e-bike) as well as in an education project.

D-Lab also offered a new class over the Independent Activities Period (IAP) in January: *Climate Solutions and Action: 100% Decarbonization of MIT's Buildings by 2035*. Taught by longtime D-Lab instructor Susan Murcott, the class attracted participants and interest from across the MIT community.

### Student projects and fieldwork 2023-2024

Coursework that's grounded in real challenges is central to experiential learning, and similar to last year, D-Lab students worked in 53 teams with community partners in Bolivia, Brazil, Cambodia, Cameroon, Colombia, the Dominican Republic, Ghana, Greece, India, Kenya, Madagascar, Mexico, Nepal, Peru, South Africa, Tanzania, Uganda, and the United States. You can find about more about these projects and their outcomes on the D-Lab website under Academics at [d-lab.mit.edu/academics](http://d-lab.mit.edu/academics).

Travel and fieldwork remain core to the D-Lab student experience. With support from MIT's Experiential Learning Opportunities Social Impact Fund and philanthropic gifts, D-Lab sent 76 students (up from 43 for the prior year) on mentored trips to Bolivia, Brazil, Cambodia, Cameroon, Colombia, Ghana, Greece, India, Kenya, Madagascar, Mexico, and Tanzania to work with community partners on projects initiated in their classes.

### D-Lab off-grid brooder saves chicks and money using locally manufactured thermal batteries

MIT News, July 2024 (excerpt)

The innovation, which employs beeswax to maintain consistent heating, is the result of three years of co-design with Cameroonian poultry farmers.



"MIT D-Lab students and instructors are improving the efficacy and economics of a brooder technology for newborn chicks that utilizes a practical, local resource: beeswax. Developed through participatory design with agricultural partners in Cameroon, their Off-Grid

Brooder is a solution aimed at improving the profitability of the African nation's small- and medium-scale poultry farms. warm. Since it is common for smallholders in places with poor electricity supply to tend open fires overnight to keep chicks warm, the invention might also let farmers catch up on their sleep."

## MIT D-LAB RESEARCH & PRACTICE

Research and Practice programs at D-Lab continue to give form and substance to our international impact and the D-Lab student experience. Research is led by Professor Kim Vandiver who serves as D-Lab Faculty Director of Research, and Associate Director of Research Kendra Leith and Practice by Associate Director of Practice Libby McDonald. These teams work on multiple longterm projects, while advancing approaches to research developed at D-Lab such as Lean Research and methodologies for community engagement such as participatory design and creative capacity building.

### Research and practice programs 2023-2024

**ASPIRE:** Third year of a five-year program working to create a model for Latin American universities and their collaborators to respond to local and regional development needs. Funded by USAID and implemented by MIT D-Lab, MIT MechE, Universidad del Valle de Guatemala, and AGEXPORT.

**Design for Second Life Innovations:** First year of a design program centered on up-cycling electronic devices provided by Samsung to create a transformative impact in low-income communities through MIT D-Lab's Creative Capacity Building program in Uganda, Tanzania, and South Sudan. Funded by the Korean International Cooperation Agency (KOICA).

**UPSKILL:** First year of a five-year collaborative USAID-funded program in the Philippines. D-Lab hosted exchange visits to MIT for university and government leaders from the Philippines, provided technical support and consultations, and began conducting assessments to identify training and technical assistance opportunities.

**Horizon Center Design program for Refugee Youth:** Final year of a program developing and delivering design education programs for refugee youth in Athens, Greece. Over five years, 819 refugee youth enrolled in the classes, 24 MIT students delivered workshops, and 12 local NGO staff members were trained as design educators.

**D-Lab Creative Capacity Building for Adolescent Health in Mali:** D-Lab staff trained a Mali Red Cross team in D-Lab's Creative Capacity Building (CCB) curriculum so that they could deliver 60 CCB workshops in 20 communities in Mali as part of a larger program on improving adolescent health in Mali.

**Design with Artisanal and Small-Scale Miners in Colombia:** Continuation of a multi-year project begun in 2019 delivering design trainings to marginalized women miners to address practical needs, combat gender-based violence, and build social and labor organizations. This year saw D-Lab working closely with the women miners on the process of government-recognized formalization.

**Off-Grid Chick Brooder for Cameroonian Poultry Farmers:** Third year of D-Lab project working with Cameroonian poultry farmers and local NGOs to develop an affordable and effective off-grid chick brooder using thermal batteries made from locally sourced beeswax.

**Volta Invasive Species Transformation Alliance:** D-Lab established a team in Ghana with KNUST, the Volta River Authority, and AICL (a local textile factory) to investigate harvesting invasive aquatic weeds for the production of charcoal, simultaneously addressing two major environmental issues: deterioration of waterways due to invasive water hyacinth and deforestation caused by the use of wood and wood charcoal as cooking fuel.

**Evaporative Cooling for Vegetable Preservation:** Provided in-kind support and lab space to recent D-Lab spinout CoolVeg to continue development of a modular evaporative cooling box.

### Korea empowers Tanzania, Uganda, and South-Sudan in tackling electronic waste.



"MIT D-Lab, in collaboration with project partners, will anchor the initiative in existing innovation centers within refugee camps and communities in Uganda, Tanzania and South Sudan Through co-design workshops and mentoring, the program aims not only to address the e-waste crisis but to transform emerging technologies into viable small businesses. How does it work? MIT D-Lab classes will engage students in a hands-on partnership with communities through design portals, using Samsung TVs and smartphones or tablets for video conferencing and field trips allowing for the testing and iteration of second life innovations."

### Sample publications

D-Lab staff publications from the past year, which are available for download from the D-Lab website, include:

Co-Design in the Himalaya: Embracing Local Knowledge and User Innovation to Address Household Energy Challenges - Dec 2023 | Robyn C. Richmond, Daniel J. Sweeney, Daniel D. Frey, Sucheta Baliga | American Society of Mechanical Engineers

Machine learning application in slow pyrolysis of biomass to predict biochar yield and quality - July 2023 | Priyabrata Pradhan and Daniel Sweeney | American Society of Mechanical Engineers



## U.S.-PHILIPPINES PARTNERSHIP FOR SKILLS, INNOVATION, AND LIFELONG LEARNING - USAID

MIT D-Lab, is one of three U.S. university programs working with Philippine government and private sector partners to promote innovation and entrepreneurship in Filipino higher education institutions through faculty and staff training, curriculum improvements, and increasing community outreach and technology transfer.

Photo: Courtesy MIT D-Lab

## D-Lab student reports and reflections

An element of every D-Lab student field experience is reporting and reflecting on the specific project as well as the full intercultural experience. Many students find that their fieldwork transforms how they think of themselves, their studies, and their world. See below for a few examples and visit [d-lab.mit.edu/blog](https://d-lab.mit.edu/blog) for more!



Improving access to hot water in Nepal September 2023 | Introduction to Energy in Global Development students



Empowering young parents in Kenya to be the architects of their own futures March 2024 | D-Lab: Gender and Development students



Testing a water vapor condensing chamber in Madagascar February 2024 | D-Lab: Development students



Unlocking freedom: transforming challenges into opportunities with the women miners of Santa Rita February 2024 | D-Lab: Gender and Development students



Fostering a circular material economy in Cochabamba February 2024 | D-Lab: Development students

## D-Lab students and alumni in the news

Many of our students continue the work they started in a D-Lab class for years to come. Some pursue academic research, others develop products and services and start businesses. See below for just a few news articles about our alumni and visit [d-lab.mit.edu/news](https://d-lab.mit.edu/news) for more!



Sophia Chen '24  
Sophia Chen: It's our duty to make the world better through empathy, patience, and respect May 28, 2024 | MIT News



Adi Mehrotra PhD candidate  
Designing cleaner vehicles November 1, 2023 | MIT News



Pedro Reynolds-Cuellar PhD '24  
Culturally informed design: Unearthing ingenuity where it always was January 3, 2024 | MIT News



D-Lab: Development, Mexico  
Designing solutions to ensure equity in health care March 27, 2022 | Perkins School for the Blind



Daisy Wang '24  
Designing solutions to ensure equity in health care April 2, 2024 | MIT News

## Looking ahead

As we look ahead, D-Lab will continue to serve as a hub for equitable design at MIT, harnessing the strengths of the MIT community and our partners around the world to address global poverty challenges. We plan to increase our collaborations with MIT faculty and labs and embed a systems lens into our research and practice programs to achieve significant and sustained impact on development outcomes abroad. And, we intend to provide expand opportunities for students to bring their whole selves to their research and fieldwork!

