Working Minds and Hands: Learning through Teaching about Technology Evaluation

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What is the general context in which the story takes place?

Over the last 20 years, technological solutions for development problems have become increasingly popular. Markets are flooded with "appropriate technologies" such as cook stoves, water filters, and solar lanterns. Although this growing availability of small-scale technologies has improved the lives of millions, it is also true that some are more effective than others. To date, decision-makers do not have a systematic way to identify "what works."

The Comprehensive Initiative on Technology Evaluation (CITE) is an interdisciplinary partnership between USAID and MIT. The goal is to create a methodological framework that allows development organizations to evaluate technologies they may use to help people living in poverty. The cornerstone of our method lies on three evaluation principles: suitability, scalability, and sustainability.

CLA is at the core of everything CITE does, but one activity piloted in 2015 has shown particular promise in this regard. CITE partnered with MIT's International Development Living Group (iHouse) and two international NGOs in the Exploring the Case for Technologies in International Development project, which uses a case-based approach to identify contributors to success and failure during the implementation of technologies in specific development contexts.

Our method combines a class for undergraduate students living at the iHouse during the spring semester, with six weeks of fieldwork in partnership with an NGO, culminating with the writing of an individual technology case study. The material produced informs CITE's broader research agenda and can be used as instructional material for similar classes in the future.

What was the main challenge/opportunity you were addressing with this CLA approach or activity?

CITE works on two parallel fronts: experimental evaluations and systems of learning and diffusion. The first consists of developing and conducting a series of pilot product evaluations in which the lessons learned in the

previous round inform the development of the next. For example, CITE conducted an evaluation of solar lanterns in Uganda in 2014 that informed an improved evaluation design for the next round, which happened in India, assessing water filters, in 2015. The second front includes activities to ensure learning is maximized throughout the duration of the project, and awareness about the importance of technology evaluation is spread as widely as possible.

An important part of this second approach is what we call "learning by teaching" (LBT). This idea comes as an approach to achieve three objectives simultaneously. First, as an institution of higher education, MIT ensures that all the research projects with which it is involved offer opportunities for student engagement. CITE, in particular, recognizes the importance of student participation as a way of raising awareness for the important research that it does. In addition to hiring students as research assistants, CITE has created a course through which we can share the CITE insights with a larger number of students, thereby maximizing the program's reach.

The second challenge CITE faces is to increase the number of data sources it can rely on to develop its technology evaluation method. Time and resources are limited, so the CITE evaluations are complemented with creative sources of gathering data that can generate useful insights for the project. Once again, involving students through a class offers several advantages. Even if they have little experience, properly trained and supervised students can become active creators of knowledge, increasing the quality of their education while producing critical information for the program.

A third and related challenge is how to communicate with organizations working with development technologies in practice. As important as it is to create better ways to evaluate products, we also need to understand how real organizations are making technology choices with existing methods. By integrating the class with subsequent fieldwork, selected partner organizations could host students, thereby opening an opportunity for meaningful engagement and mutual learning. Students prepare to conduct field research during the semester, subsequently applying what they learned in the field, which is then synthesized in the form of a case study. The organizations that receive the students benefit from having a case written about a technology they use, which helps them understand their own successes and limitations.

Most important, the production of the case study allows the impact of LBT to go beyond the project. The document becomes a source of information for CITE's broader research team, class material for future students of the subject, and technical reference for the countless organizations that can access these publications through CITE's website.

Describe the CLA approach or activity employed.

Since the beginning of CITE in 2012, the LBT approach has taken many forms, the Exploring the Case for Technologies in International Development project being just one of its most recent initiatives. For example, an "Evaluation of Technologies for International Development" course was offered to MIT graduate students in 2013. There is also a Massive Online Open Course (MOOC) on the same theme currently being developed in partnership with Edx. However, this case-based pilot is unique because it explicitly combines the CLA approach with MIT's motto, *Mens et Manus* ("Mind and Hand"). MIT guides us to think deeply about problems and potential solutions, but without forgoing the need to test our ideas and technologies in the real world. Transformative knowledge emerges when theory meets practice.

It was by reflecting upon these two sets of principles, and the lessons learned from CITE's previous experiences, that we created this project. One of these lessons, for instance, highlighted the importance of taking better advantage of MIT's social capital. There are dozens of international development organizations on campus, but we need to be better at working collaboratively and avoiding duplication. This is why, for this particular activity, we did not want to start "big" and "alone." Rather, we wanted to start small, form strategic partnerships, and then let the quality of the work speak for itself and grow organically.

The first step was to offer our course specifically to students living at the iHouse. Partnering with them gave us access to a pool of talented students interested in international development. At the same time, this move made

sure our course was creating an "evaluation mindset" in students who were already engaged with other activities related to international development. We started with three volunteer undergrads; through this comprehensive training, we sought to enhance their potential as effective knowledge multipliers.

The course was also designed with specific features to enhance the scale of our impact and the depth of the knowledge created. Two advanced Ph.D. students—CITE fellows with extensive experience living and working in developing countries—worked as instructors, responsible for leading the activities and guiding students in the classroom and in the field (via Skype). Classroom activities focused on procedural issues, such as basic research methods, and preparation for fieldwork. It also encouraged students to think critically about preconceived ideas of development, technology, and impact. CITE's previous course ended with a term paper, which halted students' learning experience with the closure of the course, and limited the data generated for CITE's further use. Now, six weeks of summer fieldwork make sure the learning would go beyond the classroom.

The design of the field activities followed the same strategic character as the rest of the project. CITE used its network of partners to identify three local NGOs using technological solutions in developing countries. Each student was in charge of writing a case study about one organization and one of the technologies it uses. In order to do so, students conducted research on the NGOs to contribute to CITE's work and worked as part-time interns for the NGOs, working alongside the staff and learning the intricacies of NGO operations. The case study covered the challenges the organizations faced and the solutions they found to make sure their products are suitable, scalable, and sustainable.

The cases are being finalized, and will soon be presented to the broader CITE research team. The team will determine the specifics of how this information will be used in the research and future classes.

Were there any special considerations during implementation (e.g., necessary resources or enabling factors)?

Several implementation-related factors have influenced the project's performance, both in terms of the positive results obtained and the areas identified for improvement. The proactivity of the Ph.D. instructor who conceptualized the project was decisive. But the project would not be possible without the support from CITE's leadership team: They provided guidance, space for experimentation, and covered the instructors' salaries and students' travel expenses. There were also early design decisions that maximized the project's resilience in the face of unexpected circumstances. For example, starting with a pilot course proved to be adequate, because it decreased the amount of resources required, as well as the managerial complexity associated with the project.

The course design, fieldwork, and case study requirements were built prioritizing flexibility and intense monitoring. This allowed the instructor to identify problems, consult with CITE colleagues about possible solutions, and implement them accordingly. This was particularly useful when the instructor was injured in a bike accident in the middle of the semester, which made it difficult for her to complete the work alone. Because of the close contact she kept with other CITE colleagues, another Ph.D. instructor was able to jump in and support her for the remainder of the project. Another example occurred when one of the students could not participate in the fieldwork for personal reasons. The flexible arrangements established with the NGO allowed us to inform the organization on time, without compromising operations, the budget, or damaging the institutional relationship.

Even though CITE was deliberate in limiting the size of the project, coordinating all the logistical requirements was more complex than expected. One of these issues emerged as we tried to get approval from the Committee on the Use of Humans as Experimental Subjects (COUHES) for the research. The accident with the instructor plus other unforeseen documentation requests delayed the process, putting this key part of the project at risk. It took a flexible administration team to effectively liaise with COUHES and other stakeholders to comply with all the requirements within a short timeframe.

The administration team was also important in managing the relationships with the NGOs. The project partnered with organizations based in Botswana, Mexico, and the Philippines. Even with one student not conducting

fieldwork, it took time to finalize all the details regarding the terms of the partnership. It was helpful that MIT had guidelines available for these circumstances. Having these templates facilitated the formalization of the project.

Additional challenges surfaced when students arrived in the field, especially in relation to time management. One of the key incentives for NGOs in the project was that students would volunteer 50 percent of their time working for the organization. But the challenging nature of their work and the limited resources available increased the internship-related demands on the students, sometimes at the expense of the research. Through weekly Skype calls, the instructor helped them to navigate these challenges, and CITE's contact with the NGOs reassured these issues could be resolved effectively.

What have been the outcomes, results, or impacts of the activity or approach to date?

We are a pilot program, so our conclusions are only preliminary. The students are scheduled to submit the final version of the case studies by mid-September; however, we have seen advanced drafts and the quality is great. These are 40-page documents that combine primary and secondary data that would not be visible to CITE without our project. They describe key processes related to development technologies, such as the efforts of one NGO to make its supply chain more efficient, locally sourcing the parts of the rainwater harvesting system they produce, or the struggle of another NGO to balance the drive to expand the distribution of its solar energy products with the need to reconnect with former customers to enhance learning and quality control.
These case studies are the highlight of a project built on monitoring, evaluation, and adaptation. During the semester the students' progress was assessed through written assignments. The final deliverable consisted of an extended project outline for their field research and a draft COUHES application for future submission. The reaction from the students to the work with CITE was captured in the course evaluation required by MIT from all classes taught in the institutes. The course received a 6.5/7.0 score, the instructor, a 7.0/7.0.

Once in the field, the students kept journals to record their activities. An hour-long weekly debrief with the instructors via Skype gave students the chance to collaboratively find solutions for the challenges they faced and adjust the course of the research accordingly. Every two weeks, students delivered draft versions of their case study, for which they received written and oral feedback from the instructor. Although we do not yet have formal feedback from the fieldwork, the contact we have had so far with the NGOs and the students has been positive.

What were the most important lessons learned?

1. **It is effective to grow "from quality to quantity"** – Prioritizing a deep learning experience, quality in knowledge creation, and sustainable institutional relationships put the project in a better position to seek impact at scale. Most important, it made the project more resilient in the face of unexpected circumstances. Now, we have students highly aligned with CITE's work, high-quality case studies, and experience establishing partnerships that attest for the potential of the project.

2. **Scaling-up the project will take more partnerships than financial resources** – Although the overall cost of the project was small in absolute terms, the amount of resources allocated by students was significant. CITE's willingness to bear these costs for the pilot was crucial, because we needed proof of concept to assess the initiative's potential. Now, with practical results to show, many of the costs can be shared with other departments within MIT, as well as with other partner organizations.

3. **Aligning incentives does not substitute monitoring** – Spending time designing the adequate incentives for students, NGOs, and other stakeholders took time, but it proved to be effective. The CITE team was confident that all participants could benefit from the project while maximizing its overall impact. However, as the issue with student's time management in the field showed, maintaining active channels of communication with stakeholders helps to keep incentives aligned.

4. **Logistical preparedness is more important than you think** – In the early stages of the project, it was not so clear how much our activities would depend on the human, social, and institutional capital embedded in

MIT and CITE. From dealing with COUHES applications to arranging travel insurance and making agreements with NGOs, having an administrative team to manage logistical aspects, aided by existing guidelines, was in large part what made this whole endeavor possible.

Is there any other critical information you would like to share?

The process and lessons learned described in this document demonstrate that CLA was a core principle of our project. It also showed that the CLA approach can be strengthened when combined with other frameworks, such as MIT's "Mind and Hand." As one of the students said, "[We] learned a lot about the beauty of learning by doing and the self-exploration that comes along with it." Though still incomplete, our experience has been rich enough to share, and it can be a useful reference for organizations with similar interests.

It is also worth sharing one key takeaway we learned from the case studies, but that we did not have the space to include earlier in the application. The impact of CITE's evaluation framework will depend on how useful it can be for organizations at various levels of performance and infrastructure. In practice, development technologies hardly represent complete success or failure, but some institutions are better than others at monitoring their activities and evaluating their own performance. As we strive to make the best evaluation framework we can, it is important to keep in mind that CITE's final product should not be so complex as to exclude organizations with limited infrastructure, nor so simple that it has nothing to add to better performing ones. With our project, we hope to be active contributors toward this goal.