Audio-Narrative Production As a Tool for Enhancing Students' Ability to Contextualize and Address Sustainability-Related Problems

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Abstract

College students in STEM fields generally receive rigorous training in problem-solving, but often that training focuses primarily on the technical aspects of problems, ignoring or minimizing the human context in which those problems arise and the impacts on people who will be affected by the solutions. Terrascope, a sustainability-oriented learning community for first-year undergraduates at the Massachusetts Institute of Technology (MIT) works to engage students in a more holistic process of identifying and addressing problems. Here we describe one component of the Terrascope program: Terrascope Radio, a class in which science and engineering students change gears from technical problem-solving to focus on producing audio stories. In the process, they acquire a richer and broader understanding of the context and implications of their own more technical work. Student outcomes include: Increased focus on understanding and addressing the needs and priorities of the people affected by sustainability-related problems. Engagement in seeking out multiple perspectives on complex sustainability-related issues. Improved skills in communicating scientific and technical information. Enhanced respect for the role of communication in technical and scientific practice. Enhanced ability to collaborate with a diverse group on creative projects; enhanced general teamwork skills. Experience adapting on the fly to changing conditions and priorities within a project. Increased ability and willingness to reach out to expert sources of information. Increased competence in conducting interviews and in being interviewed, both inside and outside the audio-production context.

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Change of Perspective

As students come to realize, in order to get and hold the interest of general audiences, they need to take a less technical, more specific and personal, view of the issues.

JESSICA FUJIMORI, Terrascope Radio 2011 (topic: addressing global hunger; field trip: Sirsi, India; link to program: https://terrascope.mit.edu/radio/food-for-thought/)

In the fall semester of Terrascope, the world grew large. As we talked and debated and read about global food insecurity, I felt my brain swimming with the vastness of it. This was not one problem; this was a complex system of problems that differed depending on geography and politics. In multivariable calculus we were learning to integrate in three dimensions. In Terrascope, there were too many dimensions to count. Hunger, poverty, corruption, inequality.... As we became overwhelmed with the immenseness of it all, we each gravitated toward subjects we were interested in or comfortable with (I wrote a tome about primary education).

In Terrascope Radio, the world came into focus. We began to learn to listen. We explored Sirsi, India with our headphones on and our microphones at the ready. We interviewed farmers about their agricultural practices. We talked to merchants selling fruits and vegetables at a market. We captured the sounds of villagers' hoes biting the earth as they laboriously chunked out the terrace farms we had dutifully researched, typed up and posted to our class website months earlier. This was the soil on which they would grow the food that would sustain them and their children. How would our lists of agricultural technologies and government policies and school programs fit into these people's lives?

It can be easy for scientists or engineers or policy-makers to design from afar. Terrascope Radio was about communication and our presence in the world. Pay attention to what's around you. Ask the right questions and really listen to the answers. Allow some silence. Linger for a little while after a conversation, and then the real conversation will start. Remind yourself why you're doing what you're doing. Get out into the world and just listen.

Process-Based Learning

During the first half of the semester the class concentrates on storytelling techniques, and on giving students experience using equipment and software for gathering, editing and mixing sound. We listen together to a wide variety of audio stories, and students discuss them, identifying aspects of each piece that worked (or didn't work) for them and gradually building their toolboxes of techniques and approaches. These classes serve another purpose as well: they begin to make the classroom a safe space for critique and for diversity of opinion, so that when students begin creating their final project they will already be accustomed to listening analytically, understanding one another's tastes and perspectives, and providing informed feedback. This makes the task of critiquing one another's work less fraught and more productive. Students become familiar with audio equipment and software through a variety of small projects. Through listening to and critiquing one another's pieces, students start using some of the conceptual tools they have acquired during listening sessions.

EMILY MOBERG, Terrascope Radio 2008 (topic: restoring and protecting global fisheries; field trip: Iceland; link to program: https://terrascope.mit.edu/radio/iceland-volcanoes-geysers-and-fish-oh-my/)

In class we listened to curated radio pieces that illustrated creative approaches to telling stories, expertly captured pieces of audio, and evocative uses of sound. These pieces illustrated the possibilities that this new medium afforded us, while training us to really listen more closely than I was accustomed to doing. Did that voice sound like it was in a boxy room? A stairwell? Did that implied space alter the story or mood? We were encouraged to comment on the pieces, both positively and negatively. I found this skill particularly useful later: it is easy either to find complete fault with something while nitpicking (and gloss over what was done well) or to glibly praise it (while missing critical failures).

Our radio pieces were also produced in groups, which was a unique crash course in creative teamwork. Teamwork in other classes typically involves a more dispassionate division of labor and feedback; in radio production, feedback to teammates reflected on their unique ideas and their execution, which felt so much more personal and subjective. We had to balance deadlines and our own conflicting visions for the project, figure out how to incorporate different workflows, and interact effectively with each other.

One of the most valuable skills I learned in this class was assertiveness and the possibilities that just asking could produce. We walked into a church service in Reykjavik as it was starting, asked if we could record the singing and got a tepid yes; other times we got a firm no. We were able to interview the Icelandic Minister of Fisheries and an executive at a whaling company. I learned that the worst outcome of an ask was a polite no, and the best outcome was an opportunity I had previously never imagined being possible.

Field Trip

During spring break Terrascopers travel to a place relevant to the year's topic, providing an excellent opportunity for radio students to conduct interviews and gather sound. They must be purposeful, but they must also remain open to discovering new stories and angles. In the evening they gather to transcribe their sound, play highlights, and develop their sound-gathering strategy. They also start to formulate possible story ideas.

EMILY MOBERG, Terrascope Radio 2008 (topic: restoring and protecting global fisheries; field trip: Iceland; link to program: https://terrascope.mit.edu/radio/iceland-volcanoes-geysers-and-fish-oh-my/)

When we learned that the Icelandic Minister of Fisheries had agreed to an interview, equal parts excitement and dread filled me. In my mind it launched our radio story from a potentially cobbled together class project to a real journalistic endeavor. I believe it was the radical combination of that responsibility with a creative medium that made Terrascope Radio so impactful. We were given the freedom and encouragement to brainstorm, sketch, and plan a piece as wild and inventive as we pleased, but the opportunities—both for recording and for broadcasting—made me want to produce an excellent piece as well.

On our trip, we balanced the responsibility for collecting high-quality sound with the exuberance of teenagers. We recorded the sounds of our footsteps on every surface we walked on. We recorded each other snoring when we fell asleep working. We recorded our classmates' reactions when we joked that the ice cream was made of whale's milk. In retrospect, this wanton exploration was incredibly useful: we quickly developed more recording skills, and more importantly learned that the "crazy" idea for a recording is sometimes actually a great, usable one!

The variability of interviews and recording were both exhilarating and frustrating. An unexpected answer could render our prepared questions moot, so thinking quickly on our feet was critical. We had to collaboratively and spontaneously make decisions on where our limited microphones would go. They ended up thrust into faces, bins, shorelines, and fish-processing machines. We interviewed a shop-keeper who told us about elves, an engineer at a geothermal plant, fishermen, museum curators, tour guides, students, and, of course, the much awaited Minister of Fisheries. (That interview passed in a blur—I mostly remember staring at the little row of lights that indicated we were recording sound correctly)

Crafting a story around the sound we collected was another challenge, as the initial plans we'd made did not mesh with the material we had actually collected. We spliced, edited, wrote, re-wrote, gave feedback, disagreed with feedback, recorded, and re-recorded the requisite pieces to weave together our full program, barely in time for it to air on our campus radio station.

Abstract

College students in STEM fields generally receive rigorous training in problem-solving, but often that training focuses primarily on the technical aspects of problems, ignoring or minimizing the human context in which those problems arise and the impacts on people who will be affected by the solutions. Terrascope, a sustainability-oriented learning community for first-year undergraduates at the Massachusetts Institute of Technology (MIT) works to engage students in a more holistic process of identifying and addressing problems. Here we describe one component of the Terrascope program: Terrascope Radio, a class in which science and engineering students change gears from technical problem-solving to focus on producing audio stories. In the process, they acquire a richer and broader understanding of the context and implications of their own more technical work. Student outcomes include:

- Increased focus on understanding and addressing the needs and priorities of people affected by sustainability-related problems.
- Engagement in seeking out multiple perspectives on complex sustainability-related issues.
- Improved skills in communicating scientific and technical information.
- Enhanced respect for the role of communication in technical and scientific practice.
- Enhanced ability to collaborate with a diverse group on creative projects; enhanced general teamwork skills.
- Experience adapting on the fly to changing conditions and priorities within a project.
- Increased ability and willingness to reach out to expert sources of information.
- Increased competence in conducting interviews and in being interviewed, both inside and outside the audio-production context.

Setting

Terrascope is a learning community for first-year undergraduates at MIT, a setting in which students work in teams on complex sustainability-related problems while exercising a great deal of autonomy over both their process and their products. Most Terrascope students enter the program in the fall semester, taking a class called "Solving Complex Problems." In this class the instructors present the students with a single large problem, or "mission." The problem is always a real one for which there is no perfect solution—one for which trade-offs are necessary. The problem always has something to do with sustainability, and it is always one that cannot be solved using science and technology alone; in order to address it, one must understand and reckon with social, political, ethical, historical and other factors. This problem then becomes a theme for the rest of the year's Terrascope classes.

The students' deliverables are: a website presenting their solution in full technical detail and a presentation and defense of their solution in front of a panel of global experts. Beyond those deliverables (and their associated due dates), the students are given very little direct structure or guidance. Faculty, staff, Undergraduate Teaching Fellows, librarians and alumni mentors are all available to give support, but the project is fully in the students' hands.

These deliverables are both aimed at audiences that are already interested in (and readily able to understand) the technical details of the problem. But what about the great majority of people who are not technically-minded, and who might not think they are interested in whatever problem the students have been studying? That is where Terrascope Radio comes in. In this class, offered in the spring, the students' final project is to create a radio program, of interest to general audiences, related in some way to the year's problem. Students have complete control over format, content, style and other aspects of their program. In this poster we describe some of the class's process and outcomes, largely through students' reflections on their experiences in it.

Importance of Communication in Science and Engineering

One fundamental outcome of the class is that students develop new respect for the importance of communication in scientific and engineering practice. It's not enough to have the brilliant ideas and invent the new technology—you have to be able to explain what you are doing and why it matters.

ELISE CHAMBERS, Terrascope Radio 2009 (topic: access to fresh water in western North America; field trip: Arizona; link to program: https://terrascope.mit.edu/radio/just-add-water-life-in-arizona/)

Terrascope Radio was that class that I never knew I needed. I still maintain that it was the best class I took at MIT. It changed how I did everything else in my career afterward. After the class, I couldn't help but think about how technical subjects were being communicated. I already had some pretty extreme pet peeves about powerpoint presentations, but after Terrascope Radio I developed even higher standards for how we should share our technical knowledge with the world. I am a visual and kinesthetic learner, and so communications that use only sound often went in one ear and out the other. Through Terrascope Radio, I not only developed how I absorbed audio information, but also used my own auditory "weakness" to challenge my teammates to make our pieces more digestible and easy to understand. After college, I worked in environmental consulting for several years. During that time, I saw that more than half the battle of doing a project "right" is communicating it well to your stakeholders and especially to your client. Terrascope Radio was a launching point for me in thinking about how we as scientists and engineers communicate our knowledge, our work, our successes, and our failures to those to whom it is important. What if all we had was audio? What would you say then? How could you help someone understand something they've never studied? These questions become all too real for me in our current age of tweets before facts and "fake news" versus science. How could this conversation change if we all knew more about how we communicate ideas? And what might happen if we were all forced to listen to each other for a little while, as in a Terrascope listening party?

EMILY DAVIDSON, Terrascope Radio 2007 (topic: rebuilding New Orleans after Hurricane Katrina; field trip: New Orleans; link to program: https://terrascope.mit.edu/radio/nerds-in-new-orleans-no-were-not-here-for-mardi-gras/)

I took Terrascope Radio more than ten years ago, and while I loved it as a student, I am also thankful for it a decade later. As a student, I was initially drawn to the class as an opportunity to travel, to directly interview people I wouldn't have an opportunity to speak to otherwise, and to work in a medium I was unfamiliar with. Once in the program, I particularly enjoyed how working with radio developed my ability to listen, to carry on conversations with anyone, and to create story arcs.

Today I am a postdoctoral researcher in materials science (and previously a high-school teacher with Teach for America). I have seen too many conference talks where nobody in the audience understood what the presenter's point was, and outreach talks to middle-school students given in unreasonably technical language. I have seen promising projects and scientific collaborations fall apart because scientists couldn't directly and succinctly tell the story of their work in ways that were correct for their audiences.

The farther I get from MIT, the more clear it becomes that excellent communication is essential to a successful career in science and engineering. Recently I was told that I have a 'gift for articulating the most complicated of scientific concepts.' While I strongly appreciated the compliment, I think this was partially misattributed. I don't have an innate gift; I am a reasonably good scientific communicator because I have practiced and have been trained. Terrascope Radio was, for me, one of my most important and rigorous early experiences in learning to communicate complex ideas tailored to a wide range of people.

Impact on Later Career

For some, the process of finding and telling stories has shaped their lives in deeper ways, affecting how they interact with others, how they develop ideas, and how they choose their work.

ANISHA GURURAJ, Terrascope Radio 2012 (topic: preserving global biodiversity; field trip: Costa Rica; link to program: https://terrascope.mit.edu/radio/pura-vida-costa-ricas-culture-of-conservation/)

The first time I understood what it truly took to work to create social impact, I was standing at a worn-down gate in front of the porch of a tiny house in Santiago, Costa Rica. An older couple sat on rocking chairs, their expressions lined with skepticism as they eyed the three of us, college kids with recorders and microphones. It was one of our last days on the Terrascope trip to Costa Rica, where we'd hoped to better understand how the global biodiversity crisis manifested in a particular social, environmental, and geographical context. Having spent the week trudging through rainforests, inspecting caterpillars, and talking to scientists, ecotourism workers and nature guides, the three of us had ventured out on a whim, to see whom we might bump into. At first the couple seemed unwilling, providing monosyllabic answers. Slowly we moved closer to the porch as they began to tell us about the husband's work on a cacao plantation before it shut down. Instead of the effects on the area's biodiversity, he was telling us about what life as a plantation worker had meant for him and his family. Before we knew it, the gate opened and we had been invited inside—the husband pulling us into the garden to show us what a cacao plant looked like, and the wife showing us around her home, telling us about her difficult childhood and her family members, even breaking down in tears at one point. The three of us were in tears too, moved not only by her emotion but by the power of this unlikely, unexpected moment in which we were invited into the intimacy of a stranger's life.

People often say that they use very little of what they studied in college in their real life, but it's difficult to overstate how many times I've reached back to Terrascope Radio, that completely anomalous class from my freshman year, one that I think about more often than even my technical classes. The stories we heard and learned how to tell were unlike those we tell in science or engineering, which tend to be linear, causal, analytical and rational. For all of us who believed that we could make technology and innovation weave its way into actually impacting real lives, this was an early glimpse into the real world, where we learned that the most relevant stories are complex and collect all the parts into a coherent whole. Twelve of us came back with hard drives full of sound, already composing different stories in our heads. We had experienced self-organizing and working across divisions in the fall Terrascope class, but that was a science project, not a piece of art. Terrascope Radio helped to blur the increasingly irrelevant lines between the two. By listening to and creating stories through sound, I began to appreciate and break down the mechanics involved in the inspiring (at times infuriating) art and science of telling stories that are multi-dimensional, winding, and complex.

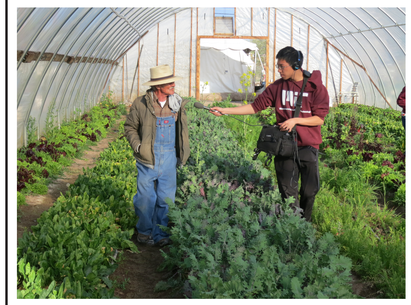
Perhaps the most important thing I learned was a skill that I never really thought mattered for anyone other than journalists: interviewing. That day in Costa Rica, and so many other days on that trip, I unknowingly began to figure out the nuances of interviewing—what piques an interviewee's interest, the power of silences, how to build someone's trust in less than a minute, and what can completely turn someone off. There was also the adrenaline rush when you did it right and realized you had stumbled upon the pot of gold. It's a set of muscles that I've come back to again and again, from interviewing trauma surgeons after the Boston Marathon bombings, to designing my research in grad school (studies to inform the design of a low-cost ultrasound device for rural Indian primary health centers), to serving as an emotional support volunteer at a rape crisis centre. In my professional life I continue to gain appreciation for the ability to approach people and worlds, even ones that I am familiar with, with a genuine curiosity, a desire for depth and a willingness to suspend assumptions. Whether interviewing one of my closest friends about the sounds that take her back to her childhood, approaching strangers in Costa Rica, or designing medical devices for a low-resource setting, you don't know what you don't know.

Terrascope Radio gave me another thing as well: an understanding of the sheer responsibility that comes with representing others' stories in your work, the power they are putting in your hands to hold and share these stories with gentleness, compassion and deep respect, whether you do it through words on paper, voices on the radio, or products on the market.

Human Context of Technical Work

By focusing on stories and storytelling, Terrascope Radio helps students acquire an appreciation for the human context in which the technical problems they have been studying occur. It helps them to refocus their efforts on the people being served by their solutions, not just the solutions themselves, and to make serving those people a priority.

BRANDON WANG, Terrascope Radio 2016 (topic: food insecurity and climate change; field trip: New Mexico and the Navajo Nation; link to program: https://terrascope.mit.edu/radio/journey-through-new-mexican-agriculture/)



The spoken word is powerful. It's complex, rich, and full of meaning. It's also slippery and unpredictable. In editing our piece for Terrascope Radio I've listened to segments of interview tape over and over—looking for the rhythm in a conversation, just the right lilt in an answer, a meaningful pause taken. Your voice is personal stuff. When we talked with people in New Mexico, it was usually off-the-cuff, informal conversations with people who had agreed to talk to us. Sure, they knew they were being recorded, but they felt comfortable speaking their minds, and we got to engage in authentic conversations.

In class we talked about the ethics and gray areas of audio editing. One can easily splice together sentences, cut out words, and change someone's message. We cut pauses and entire phrases to make a point more quickly or more crisply; this is an integral part of making an audio story. But there is always a tension between the interests of the producers (us) and of those being interviewed. We try our best to ensure that our piece accurately conveys their thoughts, and that we simply act as a medium for them to tell their stories.

But that's not guaranteed, and with the tape sitting in our hard drives, we have the power and the responsibility. Looking back now, our study of such a human experience—talking—and a personal medium—the voice—helped me realize the importance of individuals and the personal when understanding the world. As a student studying computer science, I'm often aware of engineering solutions that are conceived, created, and foisted on the world without much thought to the individuals and communities they impact. It's really easy for engineers and technologists to become isolated from the ultimate question driving our work: Does it benefit the people? Terrascope Radio taught me that it's not an easy question, and that we cannot expect easy answers. Asking these questions isn't a box to be checked off; it should be a conversation—and Radio taught me that while it's impossible to get perfect, it's always worth it to try.

Further Information

Terrascope Radio productions are available for streaming at:
https://terrascope.mit.edu/radio/
and subseqent pages (see bottom of page for links), and are available as .mp3 or .wav files on request.

For more information about Terrascope, see:

Bowring, S.A., A.W. Epstein and C.F. Harvey (2014), Engaging First-Year Students in Team-Oriented Research: The Terrascope Learning Community. In V.C.H. Tong (ed.), *Geoscience Research and Education: Teaching at Universities*, Innovations in Science Education and Technology **20**, Springer Science + Business Media, Dordrecht. DOI 10.1007/978-94-007-6946-5_17

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