Making Sense of Science:
Applied Improvisation for Public Communication of Science, Technology, and Health

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Applied improvisation workshops focused on communication, storytelling, and audience engagement have great potential to address the scope of challenges that scientists and physicians face as communicators. Scientists and physicians struggle to connect with public, non-expert audiences in three primary ways. First, today they face an increasing need to tailor their communication for a variety of audiences who are not scientific experts or researchers. When speaking to patients, for example, physicians must deliver a clear message while building empathy and trust. In a recent Pew Research Center study on public and scientist's views on science and society, 84% of the scientists who responded said that limited public knowledge about science was a "major problem." The study also revealed significant gaps between scientists' and the public's understanding on key issues. For example, the study found that 57% of the general public believes genetically modified foods are *unsafe* and only 37% believe these foods are safe. In contrast, 88% of the scientists in the survey said genetically modified foods are *safe*. The study revealed similar knowledge and opinion gaps for issues such as climate change, nuclear power, offshore drilling, and vaccinations. Likewise, given the wide gap in scientists' and the public's perception of how science is used to inform government policy, both research scientists and health care professionals must communicate vividly to funders and policy makers about why their work matters (Funk & Rainie 2015). Moreover, scientists ranging from researchers and professors at research institutes and universities increasingly participate in science education and outreach programs designed to promote better understanding of science among the public.

Second, instead of assuming traditional research roles in higher education, many scientists turn toward employment opportunities—in business and industry, public policy, science reporting, and science museums—requiring public communication skills. According to the National Science Foundation (NSF), 58% of doctoral scientists and engineers are working outside of 4-year educational institutions. Furthermore, a 2012 survey of nearly 5,000 PhD students in the sciences indicated that, over the course of their PhD program, students' interest in traditional academic careers decreased, while their interest

in work in private and government sectors increased (Sauermann and Roach 2012). On an anecdotal level, *Nature* has produced a popular blog series on a number of scientists who have pursued careers outside of the academy (DeLange 2013). These emerging roles and demands require the ability to communicate specific scientific knowledge to broad audiences (Funk and Rainie 2015).

Third, professors and graduate teaching assistants face the challenges of communicating effectively with students and igniting interest in scientific research. In classrooms, labs, and other learning environments, science experts and graduate student scientists-in-training must speak to undergraduate students who are taking advanced science classes for the first time as well as undergraduate students in non-scientific fields who are taking the courses to fulfill academic requirements. These student audiences require professors and graduate student teachers to present complex information in ways that not only help the students learn particular course content but also get them excited about scientific disciplines and inspire broad interest in scientific discovery.

In sum, physicians and scientists today are required to connect to and engage with the public in classrooms and other learning environments, in hospitals and public service settings, in legal and public policy settings, and much more. In every context, these experts must tell engaging stories, respond spontaneously to the needs of the moment, and explain their work in terms non-scientists can understand. Applied improvisation (AI) training helps scientists and physicians find ways to make sense of science with a wider range of audiences who would benefit and learn from their ideas. AI offers an experiential technique that helps moves scientists away from thinking “My goal is to deliver this information” toward realizing “My goal is to create understanding in partnership with another person.”

Applied Improvisation for Science and Health Communication

Organizations across the country are applying improvised and scripted theater methods to address the communication gap between scientists, physicians, and the public. For example, the Alan Alda Center for Communicating Science at SUNY – Stony Brook has developed innovative curricula based

on Viola Spolin's theater games that help scientists transform their approach to talking to the public about complex research. Likewise, the Medical Improv program created by Katie Watson at Northwestern's Feinberg School of Medicine and Belinda Fu at the University of Washington works with health care providers to help them communicate more effectively within their teams and with greater empathy and clarity with their patients. At the University of Michigan, the CRLT Players (Center for Research on Learning and Teaching) perform interactive sketches facilitated by theater teachers and medical school faculty to help medical students practice the art of delivering bad news to patients.

As communication scholars by training, we recognize the ways these programs enhance communication education, particularly the need to develop a sophisticated understanding of one's audience as a co-creator of meaning in the communication process.[i] Scientific experts need the ability to take the position of their multiple audiences. Specifically, they need the skills of empathetic imagination, perspective-taking, and responsiveness to an audience's needs and interests (Brownell, Price, & Steinman, 2013). AI helps develop these skills. A successful improviser must carefully listen to every offer that is made on stage, respect his or her scene partner as an equal participant in creating a compelling scene, and validate the realities that this scene partner offers. Likewise, successful scientific outreach and communication with public audiences requires experts to listen attentively to discover misunderstandings and preconceived notions that might thwart meaning making conversations. Training scientists and physicians using AI techniques addresses the "curse of knowledge," a phenomenon where experts forget the time that they were novices in their field and have a difficult time explaining complex information to less-informed audiences. AI helps build an orientation toward communication as a process of collaborative meaning-making that overcomes this cognitive bias. AI reframes the audience as an equal scene partner and emphasizes the importance of listening attentively to the audience, responding to the realities of the audience, and adapting to unexpected offers from the audience. Science experts learn to commit to the improv principle "make your scene partner look good." The

experiential activities that are part of an AI training program emphasize communication *partnerships* that equalize the power differentials between expert and public.

Program at IUPUI and IU School of Medicine

In order to respond to the needs outlined above, we developed a three-part workshop series at Indiana University Purdue University, Indianapolis (IUPUI) and the Indiana University School of Medicine (IUSM). Participants came from a variety of disciplines, but most were technical or scientific in nature (medicine, nursing, life science, engineering). Workshop participants included professors and professional scientists and physicians as well as graduate students training to become science researchers. The participants were chosen because the University recognized a need to help current faculty members and graduate students in these disciplines develop skills in science outreach and communication for purposes such as grant writing, patient satisfaction, and teaching effectiveness. IUPUI and IUSM are affiliates of the Alan Alda Center for Communicating Science at SUNY Stony Brook University. We adapted the workshop curriculum based on a series of academic credit-bearing courses offered at Stony Brook University and based on a similar three-part series offered at Boston University School of Medicine, also an Alda Center affiliate. The curriculum had to be adapted because we needed to condense a longer series of classes (originally five to six weeks) into no more than three weeks. Our target audience of physicians, professors, and graduate students have busy schedules, and a shorter commitment made the workshops a more feasible and reasonable commitment..

Each workshop in the three-part series runs for two hours. Because our participants were primarily physicians and clinical professors, their schedules would not allow for workshops longer than two hours and any commitment longer than three weeks would have likely reduced our participants. We co-lead and co-facilitate each workshop session. The workshops meet every other or every third week, as a way to accommodate physician scientists' clinical responsibilities and other busy schedules. First, the workshops had to be scheduled months in advance in order to allow physicians to reserve time in

their clinical schedules for the workshops. Second, these professionals' schedules prevent them from committing three consecutive days or even six hours out of a single week to such a training program. In order to cater to these participants, we had to limit the workshops to two hours each and space the workshops at least two weeks apart. In addition, we requested that participants commit to all three sessions, but we could not require this attendance as the physicians' clinical schedules are unpredictable.

The workshops were capped at 16 participants in order to create cohorts where participants could develop relationships and trust with one another. The smaller cohort size also allowed us to include all participants in the activity debriefing discussions and to provide more one-on-one feedback. Every workshop series filled to capacity; however, when the workshops began several participants inevitably dropped due to clinical and professional scheduling demands. We have adjusted our enrollment cap to account for this attrition.

We have co-facilitated all of our workshops. While they could be led by a single facilitator, we find value in this ensemble-minded approach to the workshop. Before each workshop we discuss and assign leaders for each game. One of us always takes the lead in explaining and guiding participants through the game and for side coaching each activity. The primary facilitator for a give game begins the debriefing discussion; however, as the debriefing proceeds we share equal responsibility for asking follow-up questions and for encouraging participants to reflect on different behaviors and responses that we observe. Following each workshop, we debrief the workshop together and make note of the highlights, strengths, and areas for continued development.

We describe the three-part workshop format in the following sections as well as provide insights and tips based on our experiences facilitating these workshops. We outline some of the challenges and opportunities we faced in implementing this curriculum at a large research university given the level of expertise and the training of our participants. It is important to mention that, in speaking generally

about these issues below, our aim is not to stereotype the scientific and medical community or their training. Rather, we hope to provide useful context and additional considerations for those AI practitioners working with this audience.

Workshop 1, "Connecting with your Audience through Applied Improvisation"

Workshop 1 focuses on the skill of engaging an audience. All the exercises in this session have been selected to help participants practice skills such as connecting with an audience, paying dynamic attention to others, reading nonverbal cues, and responding to questions with sensitivity to the context and questioner. Importantly, the first workshop must also mitigate the fear some faculty members and physicians may have about playing games that invite participants to take risks and to change their attitude toward failure, vulnerability, and emotional expression. In our experience, it was difficult for some faculty members and physicians, especially for those concerned with prestige and professionalism, to consider taking risks and letting go in front of their colleagues. Interestingly, we observed that it was even more difficult for graduate students to let go and take risks, perhaps due to a need to prove their worth or belonging among peers. However, in most cases the participants were willingly participating by the end of the first workshop session. Facilitators should be aware of and sensitive to the levels of risk required for different improvisation exercises. The first workshop should begin with low-risk exercises that build trust, comfort, and success. Be prepared for faculty to opt out of participating, but encourage them to stay in the room and even participate as observers or reflectors in the debrief conversation. As a group develops, the reticent faculty will likely become more comfortable and see the safety in taking small risks. Rather than fearing failure, participants learn to see some failures as opportunities for positive growth and they explore how to fail with good nature while being supported by a team.

Exercises include a basic name game to help participants become familiar with their learning group and to build comfort. Zip Zap Zop helps participants think about nonverbal connections through

eye contact and gestures and gives them the opportunity to practice heightened attention to and presence with fellow players. When leading with Zip Zap Zop, we notice that our participants express (usually nonverbally) reticence and concern about the applicability of the game. As we see participants looking down and letting their attention and presence wane, we sidecoach them: “Make strong, clear eye contact,” “Make deliberate gestures,” and “Remain ready to receive the pass.” When we debrief and participants connect the affective response from the game to their work, they are moved to “buy in” to the improv method as a way to learn these skills. For example, participants discuss how the level of attention and clarity of eye contact in Zip Zap Zop is a valuable practice in their various communication contexts and with different communication partners.[ii]

Participants also play Viola Spolin’s classic Mirror exercises (1999, 61-3) to help them think about taking responsibility for their diverse audiences and giving up some control over their message in order to better attend to what the audience needs. One of the key concepts we discuss in the debrief is “follow the follower.” For Spolin, following the follower is achieved when both mirror partners reflect one another without deliberately initiating. Said differently, both participants are sharing control and willingly letting the other lead at the same time. Therefore, “follow the follower” requires a rejection of status, hierarchy, and control. We invite the participants to think about what they had to do in this exercise to help their partner be the best mirror he or she could be. We remind them that it isn't the partner's responsibility to keep up with fast or erratic motions; instead, it is the movement initiator's responsibility to slow down and make adaptations in order to help their partner succeed. Scientists, physicians, and graduate students then connect this “follow the follower” habit to their contexts of science outreach, patient interactions, or even classroom conversations. Even though they are experts in their field, they have to be willing to share control of the communication interactions in order to respect and incorporate the diverse knowledge their heterogeneous audiences. The Mirror exercise reminds

participants that they must continually work to create shared meaning with audiences, via perspective-taking and message adaptation.

The final exercise in the workshop is the Picture Story activity (described in the Workbook). This exercise provides a bridge between the concept of listening to, responding to, and connecting with an audience and the focus on storytelling in workshop two. Importantly, the Picture Story exercise provides an opportunity to help break the objectivity/subjectivity dichotomy that results from scientific training. Scientists are trained to objectively report facts and data from their work; therefore, the idea of introducing personal motivations for or fascinating stories about their work often seems counter-intuitive to their communication objectives. Picture Story helps participants consider the importance of storytelling and emotion in helping audiences connect to information that is foreign to them.

The techniques we normally use for debriefing activities required adaptation for this audience of scientists and physicians. Actors are trained to access emotions and the affective response to experiences. Conversely, doctors and scientists have been well-trained *not* to access their affective responses at work. Their training emphasizes the importance of objectivity. They attend to clear, concrete physical evidence and data, not vivid descriptions and stories. Thus, the strategies most effective for debriefing must involve making clear connections between behavior and emotion. Questions that focus on how a particular behavior elicits a particular emotional response help participants to change the way they work with one another and the public. We like to use the traditional debriefing questions: “What? So what? Now what?” This technique can help physicians and scientists to clearly connect improv activities to their daily practice and access the important affective experiences of managing stressful situations that may seem hard to control. Our participants have responded most effectively to questions that help them to clearly connect the activities to their work. For example, when debriefing the Mirror exercise, we might first ask: “What just happened? Describe that experience.” No participant’s experience is “wrong;” it is important to “yes, and” their experiences, even

if some descriptions are not positive. After several participants have shared their experiences, we ask them to describe the take-away lessons, or the “so what?”. In other words, how do they relate the experience in the exercise to their professional communication contexts? We might inquire: “Applying this exercise to your communication with patients or someone who is not an expert in your field, why would you want to 'follow the follower' when explaining a complex concept from your research?” Finally, we guide the participants to name particular communication habits they might adopt that apply these take-away lessons—the “now what?” For example: “How can you 'make your scene partner look good' when your partner is a journalist asking you about your work?” Participants often respond with examples that illustrate their understanding of co-creation of meaning. That is, communication is only effective when it clearly responds to the audience's prior knowledge and needs. As one participant explained in their post-evaluation survey, “Communication has many facets, and it's not simply ‘message sent, message received’—there are many different aspects within it that can be intercepted and improved upon.”

While the first workshop focuses primarily on audience-centered communication skills, we found that scientists and physicians also find value in discussing the connections between these games and their roles in collaborative teams such as lab teams or health care teams. One researcher (Thompson 2009) found that many of the skills engendered by AI were important to building successful scientific research collaborations. The author contends that “spending time together, practicing trust, discussing language differences, and engaging in team tasks” often encouraged a more productive team. Alternatively, “unproductive debates of expertise, expressions of boredom, and jockeying for power” often deterred the team’s ability to communicate effectively (Thompson 2009: 278). We found it valuable to share this type of research with participants as a way to expand the discussion into other professional applications.

Workshop 2, "Distilling your Message"

Workshop 2 introduces principles of clear communication and features experiential exercises through which participants practice speaking clearly and vividly about science in accessible ways. Participants practice defining their communication goals, identifying main points, explaining meaning and context, responding to questions, and using storytelling techniques to enliven messages. We coach participants to speak about their work effectively and responsively with multiple audiences, from peers and professors to family members and policymakers. One of the core storytelling-based exercises in the second workshop is Half Life (described in the Workbook). Improvisers use this game to discover the beats in a scene and develop more efficient storytelling skills. With scientists and physicians, this activity helps them discover the core elements of their message that are most exciting and engaging for public audiences. Often scientists start with disciplinary background and experimental details that only experts would understand; they leave the engaging take-away—the "so what?"—until the end of their talk. As a result, non-technical audiences often lose interest from the get-go.

Half-Life helps participants discover the central message their different audiences need to hear so that they can *start* their story with that information and hook the audience quickly. When participants move from a 2-minute summary to a 1-minute summary and finally to a 30-second summary, we side coach them to "Speak smarter, not faster" and to "Foreground the take-away message." We also use the following example from the Alda Center to illustrate the importance of a succinct message with vivid, descriptive, and accessible language. First, we share the research summary statement with the participants: "I study *Didymosphenia geminate*, an invasive riverine species that impairs the recreational and ecological values of waterways." Participants readily recognize that this may be a succinct and direct description, but it may not make clear to lay audiences what the researcher studies. In fact, even experts from other scientific fields might not immediately understand this statement. Then we share an alternative research summary: "I study rock snot, a kind of alga that forms

brown, oozing masses that look like a sewage spill. These get so big that they block rivers and kill fish" ("Dealing with Complexity" 2013: 2). This vivid and humorous description both distills the central message and helps non-scientific audiences better connect to the ideas. Just as important, it has the potential to elicit laughter which establishes a human connection and releases tension in the room. Rather than opening with complex scientific terminology, "I study rock snot" exchanges some of the expert's power and status for a shared interaction with the audience. The exercise allows us to revisit concepts like "follow the follower" from the Mirror exercise and the importance of vivid descriptions from Picture Story. One challenge we experience is that some scientists think the first summary is stronger due to its scientific precision and accuracy. As facilitators, we welcome such challenges from the participants as they allow for a richer exploration of the meaning and application of these exercises. This objection allows us to further discuss the idea of communication as a shared, meaning-making activity. First, audiences must be oriented to complex ideas in accessible terms, then the complexity can be added back in.

The low-stakes pressure of forcing participants to condense their message from 2 minutes, to 1 minute, and finally to 30 seconds also creates an opportunity for scientists and physicians to explore feelings associated with communicating in stressful situations. As mentioned above, this audience is not always adept at accessing emotional responses, thus it is important to encourage participants to discuss their emotional experience during the activities. For example, we may ask participants to speculate on why their heart rates increased during the Half Life activity.

Another centerpiece of the second workshop is the Uncertain Dialogue activity from Coopman and Wood (2004) described in the Workbook. This activity helps participants to consider how much is conveyed through nonverbal communication. Often, when we hear our participants describe the process they use when practicing for a presentation, they focus almost exclusively on the verbal message. Uncertain Dialogue uncovers the importance of the nonverbal message in developing

credibility and building a relationship with the audience. Further, Selepian and colleagues (2014) found that doctors who smiled, established eye contact, and were not angry when they discussed patient's choices, were instrumental in helping their patients achieve positive health outcomes. Thus, immediate application of the importance of nonverbal communication is apparent for our participants.

The Uncertain Dialogue requires four participants to perform a short dialogue from a script. It is the only activity that feels more like a traditional "acting" activity; for that reason, it should not be used until later in the second workshop so that participants have time to become comfortable with each other and with AI as a training technique. Facilitators should be prepared with four copies of the Uncertain Dialogue script (reprinted in the Workbook). Four volunteers (two pairs) perform an identical dialogue, but each pair performs the dialogue with a different relationship (see Workbook description), and the audience does not know that the dialogues are identical. After both pairs perform their dialogues, encourage observers to identify that the dialogues were identical and only the nonverbal elements changed, and to guess the two different relationships and contexts for the scenes. After they have reached consensus about the two relationships, lead a discussion about the nonverbal clues that helped them infer the relationships. Ask the participants who acted out the scene if they discussed how to act or if they intuitively knew how to perform their given relationship. This is a wonderful opportunity to remind your participants that the people who performed the scenes were not actors—they are regular people who knew how to "play" these roles using only nonverbal communication. You can encourage confidence by reminding participants that they have the tools already to use nonverbal communication to establish relationships, provided that they attend to it in their presentations. Then, direct the conversation toward nonverbal cues and contexts for communicating science and health information. Invite the participants to reflect on ways they can use nonverbal cues to complement their stories and create stronger relationships with their audiences. We have found this activity most effective

when it is followed by opportunities to practice both verbal and nonverbal communication in a high-profile context like a public interview.

Workshop 3, "Media Interview Training"

Workshop 3 allows participants to practice what they have learned in the first two workshops in a media interview scenario with a journalist in front of imagined audiences. The role-playing allows them to practice planning, developing, and delivering an engaging message about complex topics in an unscripted format. After each interview, invite all participants (as "audience members") to provide feedback about what stood out in the interview; what stories, descriptions, and metaphors were memorable; and what points remained unclear or relied to heavily on jargon. Workshop facilitators could consider giving each participant different imagined audiences. For example, an interview could take place on a national morning show like *Good Morning America* or on a radio show focused on bringing scientific discoveries to the public (e.g. NPR's *Science Friday*) or for a segment on a local high school's public television program where the target audience is middle school and high school students. We recommend that facilitators and trainers solicit help from a trained journalist for this portion of the workshop. While trained improvisers are certainly equipped to listen carefully and respond quickly with interview questions, it is valuable to simulate a real-life media interview as closely as possible. If you have access to a professional studio, consider taping the interviews and giving participants a copy of the interview that they can review and study.

While AI training has great potential for helping scientists and physicians practice communication skills, we must also be clear about the expectations and outcomes of such training. Behavior changes in communication take significant time and practice, particularly for communication practices that are deeply ingrained in professional norms and personal habits. Therefore, trainers should not only expect some resistance to the idea of merging storytelling with scientific reporting, but also recognize that a single workshop or workshop series will not be enough training to change habits.

Workshop leaders should stress the importance of continued communication practice and development. We are clear with participants that we do not expect them to become the next Neil Degrasse Tyson, Bill Nye, Sanjay Gupta, or Atul Gawande. Rather, they should look for opportunities to practice presenting their research to small, safe audiences such as campus colloquia or "Science on Tap" events. Consider sharing additional examples with workshop participants that they can use for further study. The three-minute thesis program by the University of Queensland, for example, offers excellent excerpts from researchers explaining technical concepts to the public. TED talks are also useful examples to consider.[iii]

Scaffolding

Across all three workshops we have found it important to provide participants with a fair amount of instructional scaffolding with each improv activity. At the beginning of the first workshop we explain to our participants that each activity builds on the previous game and exercise, and that each workshop builds directly on the previous workshop. We begin with lower risk activities (name games, ice breakers), building to higher risk, more complex ones (Half-Life, media interview). We also invite participants to make connections between the games. For example, when we debrief the Half-Life activity, we ask them to apply the lessons they learned from the Mirror Exercise and the Picture Story activity so that as they discover their central message, they are also thinking about attending to the needs of their particular audience and using vivid and emotional descriptions. We also begin each workshop with a review of the last one, reminding the participants of key takeaways. When we send email reminders for each of the workshops, we include a reflection prompt that we incorporate into the workshop conversation. For example, before the first session, we send participants a video clip of comedian Stephen Colbert interviewing physicist Brian Greene on *The Colbert Report.* We ask participants to reflect on Greene's language choices and nonverbal communication as he explains the topic of string theory to Colbert and his audience. We particularly like this clip because Colbert's training and experience in improvisation also provide opportunities to highlight how he employs improvisational

skills in the interview. All of these strategies are designed to help our participants connect the aims of the improv activities with their experiences in the lab, clinic, or classroom. Given that physicians and scientists are trained to be very linear, logical thinkers, they seem to react well to these scaffolding techniques because it helps them to clearly see immediate applications of these strategies.

Designing Your Program with the Audience in Mind

Within the network of AI practitioners, it will be important to continue exploring the benefits and limitations of training length, duration, and number of sessions. We should attempt to determine how much practice and training is required before participants begin to see effects in their practice. We may find that short introductory workshops have little effect or that spacing workshops more than a few days apart diminishes the outcomes of the training. Currently our anecdotal and experiential data as well as data from workshop evaluations indicate that participants find great value in these workshops and would recommend that their peers and colleagues complete the trainings. That said, more research should be conducted to better understand immediate and long-term outcomes. In addition, it would be valuable to conduct follow-up workshops and follow-up surveys to determine how well participants retain what they learned and to what extent they continue to practice the skills they started to develop. AI practitioners should work toward collecting this data and reaching informed conclusions about the effectiveness of this methodology because scientific audiences, in particular, are more likely to access and be persuaded by this information. To date, the majority of published data comes from medical improv training (e.g. Boesen et al. 2009; Watson 2011), which tends to focus predominantly on building interpersonal communication skills (such as empathy and listening) with patients or among healthcare teams. We are currently collecting data from these workshops and working with a number of Alda Center affiliates to coordinate data collection across multiple institutions (is this still a thing?). Future research will explore the long-range effect of this training technique and examine the optimal amount of training for improving communication technique.

We'd also like to offer additional considerations related to bringing AI workshops to a higher education context. Higher education institutions frequently resist change. Colleges and universities are steeped in tradition, and those long-standing practices are part of faculty members' socialization. This socialization also encourages faculty members to value, even revere, hierarchy and prestige. Faculty members, and the universities in which they work, are shaped by these values. Many of these values run counter to those employed in improvisation, yet many academic programs see the importance of encouraging more team-based research and interdisciplinary collaboration (Rossing and Hoffmann-Longtin 2016). Because improv is often equated with comedy and because AI relies on experience and practice through games, faculty might perceive this approach as lacking structure or rigor.

You may want to consider the difference between voluntary versus involuntary participation in the workshop series. We had great success working with a group of faculty members and graduate students who self-selected into our cohort program. The workshops were rated positively, and we have had a number of requests for a "master class" or additional training (see the "Impact of the workshops" section for more). Alternatively, we had a less successful outcome with a group of first-year PhD students in biomedical sciences. These students were required to participate in the program as a part of a first-year course. Students in this program were less likely than their voluntary counterparts to see the connections between the AI method and their need to present complex work to a variety of audiences. As you consider your training program, talk with your client about the advantages and disadvantages of requiring participation in the program. Be realistic about what you are able to accomplish with reticent participants, and ensure that you establish your credibility, early on, with your client requesting the workshop as well as with the participants in order to build value and trust.

One strategy we have found especially successful is to partner with an "insider" when developing the training. You can accomplish multiple goals by asking your client if there is a scientist or physician on the team who would be open to this type of training and willing to serve as your partner or

"guide." First, the partnership helps you to gather information about pockets of resistance or concerns that you may need to address early on. Your partner can help you identify challenges and ways to mitigate them before the actual training occurs. The partnership strategy also helps you to "translate" some of the language of improvisation into the context of science, medicine, and/or higher education. By speaking the language of the context, you establish credibility and show a willingness to learn from and with your participants.

We also suggest exploring alternative formats that have the potential to reach greater audiences in higher education settings. For example, in order to generate interest in the communicating science workshop series, we have offered two-hour teaser workshops that included four activities from the three-session workshops. We have also facilitated a ninety-minute workshop focused almost exclusively on listening and adapting to your audience. The experiential training in these shorter workshops still provides participants with the opportunity to learn, practice, and reflect on communication habits simultaneously. These shorter formats also provide opportunities for participants whose professional workload will not accommodate a three-week workshop series. However, once again, we have to be careful not to promise transformation or immediate return on investment. These workshops simply offer a foundation for ongoing practice and development, and they also generate interest in the workshop series.

Leave Them Asking for More!

We have facilitated this "Making Sense of Science" workshop series five times. On all occasions, it was well received and generated more interest than we had anticipated. Several senior administrators on our campus expressed interest in ongoing investment in this workshop series, and we received invitations to conduct additional workshops for departments such as the IU School of Nursing. We are also working with the Office of the Vice President for Research to conduct the series for faculty who have received large, internal grants. Given that these "Grand Challenge Grants" are designed to address

major and large-scale problems facing humanity, it is more important than ever that the recipients (scientists and researchers) can speak about their research in a compelling way and connect with the community. The following outcomes and impacts not only indicate the strong desire for the kind of experiential training that these AI workshops provide, but also suggest that participants have found the workshops valuable and rewarding.

Initial participant perceptions of the workshops are strong, with most participants citing an increase in confidence and in their ability to perspective-take with their diverse audience members. Furthermore, the following testimony is an example of our participants' perspective on the take-home message of the program: "Communication is a two-way street, and you have responsibility not only in a speaker role, but also in a listener role to achieve efficient communication."

In addition to positive responses from program participants, we have been invited to present and/or collaborate in multiple venues across our institution including our School of Nursing PhD program (with courses focused on community advocacy), our university teaching center, and residency programs in the Department of Pediatrics and Emergency Medicine. In particular, the pediatric residency accrediting organization requires that all participants complete a community advocacy rotation, focused on providing healthcare expertise to and connecting with the public, thus making this type of curriculum a useful tool. AI professionals may find it valuable to become familiar with accrediting requirements and standards for science and professional health education programs in order to tie the outcomes and goals of AI workshops to the accreditation standards. Such connections may help AI professionals make stronger arguments for the importance of workshops like the ones we describe.

Improvisation offers an opportunity for those working in the scientific and medical communities to move beyond traditional, skill-based public speaking or media training. The AI approach asks participants to consider their own identities as professionals and their commitment to public understanding of science and health. While still in the early stages of exploration, the three workshop

series method we employ at IUPUI is an important step in helping scientists and physicians to acknowledge the expertise of audiences and grow in their ability to collaboratively make meaning with their audiences. We encourage AI practitioners to build relationships with universities and organizations designed to increase public engagement in science and health as a first step in closing the gap between physicians, scientists, and the public.

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Workbook Activities

EXERCISE 1.1: Picture Story
This full-group exercise allows participants to reflect on the importance of vivid and emotional storytelling. It requires a moderate level of risk and disclosure.

Learning Outcomes:
This exercise is suited both for the science and health professions community we are targeting, as well as any group that would benefit from considering the power of storytelling for developing strong, personal connections to audiences.
At the end of this exercise, participants will…

- Have the opportunity to practice sharing a personal story
- Experience the power of vivid description and storytelling in connecting an audience to information
- Reflect on opportunities for telling stories about their professional work
- Feel more connected with their community of participants

Running the Activity:

1. The facilitator holds a blank sheet of paper and tells the participants that she/he has a picture to share with the group. The facilitator describes in detail the features of the photograph, including the story behind the photo and any relationships among the people in the photo. The goal is to create a vivid and engaging story about the photograph – to make it real for the audience.
2. After modeling the activity with this opening photograph, ask the participants if they have a photo they'd like to share with the group and pass the blank sheet of paper to anyone who wishes to tell the story of their picture.
3. Continue until all participants (or as many as you have time for) have had a chance to share a story.

Facilitator Guidelines: Because participants are sharing personal stories about a meaningful picture, we recommend avoiding side-coaching throughout the stories. In between stories, ask for more volunteers by asking, "Who else has a story to share?" (rather than "a picture to talk about") in order to emphasize the storytelling outcome.
Tips:

- Be prepared with a story to get the group started, but be careful not to make it *too* good. As the facilitator you don't want to set the bar so high that participants are intimidated to try.
- Ideally, all participants will have the opportunity to tell a story about their picture, but time constraints may prevent everyone from sharing. Given that this exercise requires disclosure and risk you may want to plan not to have everyone share so as not to force participants who are not yet comfortable with such disclosure to participate.

Questions for Reflection:

The debrief for this exercise focuses on the elements that made these pictures and stories memorable and how to incorporate similar elements in scientific communication.

- What made these pictures and their stories memorable? Why?
- How has your level of connection to your co-participants changed during this activity? Why?
- What would happen if you started to "tell the story" about your research and why you do it, rather than describing the data?
- What stories can you tell about your research? [prompt participants to think about their motivations for pursuing the research, the unlikely turn of events that led to a particular insight or discovery, etc.]

Suggestions:

During the debrief share Kenn Adams' **Story Spine** and talk about storytelling structures. Invite participants to think about how their scientific papers already follow a story structure or to think about how they can conceive of their work as a journey.

This exercise could be combined with or followed up by **Color/Advance** in order to challenge participants to balance careful and vivid description with the progress of the story.

EXERCISE 1.2: Half-Life

The exercise helps participants practice concise, yet powerful, communication and helps them discover the most important elements of their story. This activity begins in pairs and ends with a full-group debrief.

Learning Outcomes:

This exercise is suited both for the science and health professions community we are targeting, as well as any group that would benefit from making their messaging more concise and targeted.
At the end of this exercise, participants will…

- Practice delivering a specific message three times.
- Incorporate feedback to improve and alter their message.
- Listen to and observe a peer go through the process of editing and refining.
- Discuss the significance of a pointed, targeted message.

Running the Activity:

Before the workshop in which you include this activity, ask the participants to come prepared to talk about a specific research project or ongoing work.

1. Participants pair up and select person A and B. Proceed with steps 2 - 4 with Partner A, then repeat with Partner B.
2. One partner will be the speaker, the other will be the listener. The Speaker will have 2 minutes to describe his/her specific research or work. The listener should not ask questions or interrupt the Speaker; just let the Speaker fill the 2 minutes.
3. After this 2-minute period, ask the Speakers to reflect on whether they successfully shared everything they hoped to share or if they left out critical information. Ask the Listeners to provide feedback to the Speakers (no more than 2 minutes):
    - What was the main point?
    - What was still confusing/unclear?
    - What examples, descriptions were memorable?
4. Give the Speakers another opportunity to share this information, but shorten their time to 1 minute. Again, the Listeners should not interrupt or ask questions during the 1-minute period.
5. After this 1-minute period, again ask the Speakers to reflect on whether they successfully shared everything they hoped to share or if they left out critical information. Ask they to think about what information they *really* want to share and what information they could omit. Again, ask the Listeners to provide feedback to the Speakers (no more than 2 minutes):
    - What was the main point?
    - What was still confusing/unclear?
    - What examples, descriptions were memorable?
    - What changes did the Speaker make that helped/hindered the story?
6. Give the Speakers one more opportunity to share this information, but shorten their time to 30 seconds.

7. After this 30-second period, ask the Speakers to reflect on whether they successfully shared everything they hoped to share or if they left out critical information. Ask the Listeners to provide feedback to the Speakers (no more than 2 minutes):
    - What changed over the three versions of the story?
    - What changes helped the story?
    - What changes hindered the story?
    - What was still confusing/unclear?
    - What examples, descriptions were memorable?
8. Repeat steps 2-7 with the Speaker and Listener roles reversed.
9. Debrief the exercise with the fully group.

Facilitator Guidelines: *This is for side-coaching tips* (e.g., "Make and hold a pose"; "Find a way to connect"; "If your idea is the same as one previously introduced, that's what we call reincorporation"), *and/or things the Facilitator should be observing* (e.g., Identify which participants are resistant to trusting their first impulses).
Side-coaching: During the 1-minute and 30-second version, remind the Speakers:

- "Talk smarter, not faster."
- "Find the crux of the story."
- "What does the audience *need* to know"

Questions for Reflection:

- Describe the difference between your first attempt (2 minutes) and your final attempt (30 seconds). What changed?
- What did you notice about your message as the time got shorter?
- What changes did your partner make that improved the focus of the message?

Suggestions:
With groups of eight or more this exercise is best run in pairs. However with a small group of 3-6, it could be run with the full group where each participant has the opportunity to winnow their message and to receive feedback on the process from the rest of the group.

Consider sharing additional examples with workshop participants that they can use for further study; for example, the three-minute thesis program by the University of Queensland (http://threeminutethesis.org/) offers excellent examples of researchers explaining technical concepts to the public. TEDx talks are also useful examples to consider (http://www.ted.com/watch/tedx-talks).

EXERCISE 1.3: Uncertain Dialogue

This exercise requires four volunteer participants who are willing to read/perform a short dialogue for the rest of the group. The exercise focuses on the power of nonverbal communication cues.

Learning Outcomes:
At the end of this exercise, participants will…

- Reflect on familiar and common sense nonverbal codes
- Make a plan for their communication practice beyond the verbal content.
- Discuss how to build relationships with communication partners through nonverbal means.

Running the Activity: *(Provide step-by-step instructions in this section; example is abbreviated)*

1. Four participants (two pairs of two) receive the following short dialogue. One pair is instructed to read the dialogue as if they are a couple ending a long-term relationship. The other pair is instructed to read the dialogue as if they are about to rob a bank. The remaining participants (the audience) does not receive a copy of the dialogue, nor do they know the characters that each pair has been asked to assume.

Uncertain Dialogue

A: Hello.

B: Hello.

A: So, ah, how are you?

B: About the same. You?

A: Nothing new to report.

B: I thought maybe you might have something to tell me.

A: Has anything changed?

B: Not that I know of. Do you know of a change?

A: No.

B: So what do you think we should do now?

A: I suppose we could go ahead and...

B: Yeah, seems like it's a good plan.

A: Are you sure?

B: As sure as we ever can be in situations like this.

A: Want to reconsider? A lot is at stake.

B: No, I'm ready. Let's do it.

2. Give each performance pair a few minutes to review and practice their dialogue. Tell the audience only that they will be seeing two short dialogues. Do not tell the audience that the scripts are the same.
3. After each pair performs their short dialogue, ask participants to guess the relationship between the actors. Because the dialogues are identical, participants must rely on nonverbal cues (physical movements, tones, etc.) to determine the relationship.

Facilitator Guidelines: The nature of both relationships will likely lead the performers to whisper or speak softly. Encourage them to use stage whispers so the audience can hear them.

Questions for Reflection:

- Same language, very different scenarios. What happened?
- How were the characters able to establish relationships with one another using no (or in this case, the same) words?
- How can we use these strategies when we are communicating with one another?
- How can we attend to the relational level of our communication with one another?
- What message do you want to send with your tone of voice, rate of speech, space usage, and gestures? How can you achieve that?

Suggestions: Avoid providing any additional coaching or acting tips to the volunteers other than giving them their relationship. Only ask the participants to read through the dialogue a few times so they are familiar with the script, but do not directly ask them to "rehearse." Almost all the participants will rely on experience and common knowledge to arrive at the "best" way to act and this strengthens the discussion of how we make meaning out of nonverbal communication cues.

Source: (Coopman and Wood, 2004)

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[i] Both authors have dual backgrounds in educational fields and in communication studies. Jonathan studied higher education administration for his master's degree and then pursued a doctoral degree in rhetoric and cultural studies, with a minor in critical pedagogy. Krista received her master's degree in communication and then studied education leadership and policy for her doctorate with an emphasis on faculty development. Our combined training in education and communication theories have influenced our strong commitment to applied improvisation as a pedagogical technique and form of experiential learning.

[ii] We will add a note here that points to Name Games and Zip Zap Zop in other chapters in this book.

[iii] Three Minute Thesis (3MT) was developed by the University of Queensland. The 3MT website features a showcase of past presentations. http://threeminutethesis.org/

The TED Talk website curated a list of "7 talks to make you love science" (https://www.ted.com/playlists/163/7_talks_to_make_you_love_scien) featuring talks by neuroscientist Suzana Herculano-Houzel, biologist Carin Bondar, physicist Brian Greene, and Marine biologist Tierney Thys.