Effectively Communicating Astrophysics without Shying Away from Complication

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The principles of pedagogy apply to communicating research. We can draw on our experiences as educators and as scientists to most effectively convey complex information without compromising on detail or nuance.

Creating actionable goals for communication

A core tenet of good communication (and teaching!) is that it is critical to both cultivate and continually assess, relationships with those with whom you're engaging. Knowing whether you're approaching communication with the goal of interesting, educating, or building rapport shapes what you say and how you say it. We tend to be very good at this in pedagogical contexts, using learning goals to help outline our classroom interactions, but rarely think in those same terms in less formal contexts.

To the end of increased efficacy in science communication, we can employ those same strategies. The useful framing of "Students will be able to…", can help establish *actionable* goals for science communication. **What should/can/will your audience take away from the interaction?** Bloom's taxonomy, similarly used frequently in the classroom, can help determine the scope of those communication objectives, with achieving higher order goals necessitating different (and likely more innovative) engagement techniques than simple conversation.

Science as a matter of practice

Scientists are very good at conveying our *results*. It's both how we're trained and how we're incentivized, with talks, papers, and press releases treated as professional currency. Unfortunately, this means that most public (and student) exposure to science is through the polished advertisement of completed work. People innately understand the importance of *some of* those results, with weather forecasts, nutrition facts, WiFi, treatments and cures for illnesses, … all top of mind when asked why science is important. What is not clear to people, though, is the amount of trial and error that goes into establishing those findings and applying them to matters of everyday concern. Basic science, despite its significant return on investment (e.g., in a U.S. context, ever $1 allocated to basic science from NASA and NSF — to say nothing of NIH, DoD, DoE, etc. — returns $3 to the economy), is seen as frivolous because the process is ill-defined in public perception.

Of critical importance when we communicate science is to communicate uncertainty. Of what are we sure, of what are we skeptical? How did the result come about and what are the limitations of that analysis?

Tapping into astrophysics' greatest strengths

Astronomy, for better or for worse, is considered a gateway science. It is an innately human thing to wonder about our place in the universe, and because everyone sees the same night sky (albeit with varying degrees of light pollution), space provides a shared cultural lexicon. In fact, one of the advantages we enjoy in astronomy is that our scientific jargon is built out of a long tradition of visual astronomy and remains (mostly) simple and illustrative. For instance, a red giant star is a big, red star; a spiral galaxy has obvious arms arrayed in a spiral pattern; dark matter is matter that we cannot see; and both super-Earths and sub-Neptunes have in their names the relevant reference planet from our Solar System. We can use this to our benefit in easing communication.

As in the classroom, **it is best practice to illustrate ideas, use analogies, and draw distinctions where possible, all to provide a framework that contextualizes the science**. Taking a constructivist rather than transmissionist approach to communication encourages the audience to take ownership over knowledge and incorporate it into their own worldview. Personal investment on the part of your audience is crucial for overcoming biases and building the critical thinking skills that inoculate against misinformation.

So how do you engage *effectively* with your audience?

Think about your relationship to your audience and align communication with the actionable goals you created. Help your audience understand science not as s single result or outcome but as an ongoing process, where knowledge is continually updated. Provide a conceptual framework in which your audience can operate, both to develop a shared language around particular ideas and to give your audience ownership of that knowledge. Remember that communication stems from trust, both personal and professional, and mutual respect. Give people the opportunity to engage further — offer resources and guidelines for self-study.

Free pedagogical text for students (or anyone) interested in astrophysics.

Website full of freely available astronomy teaching resources at the college level and above.

Short, but comprehensive guide to incorporating research practice in the classroom.

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