iStock
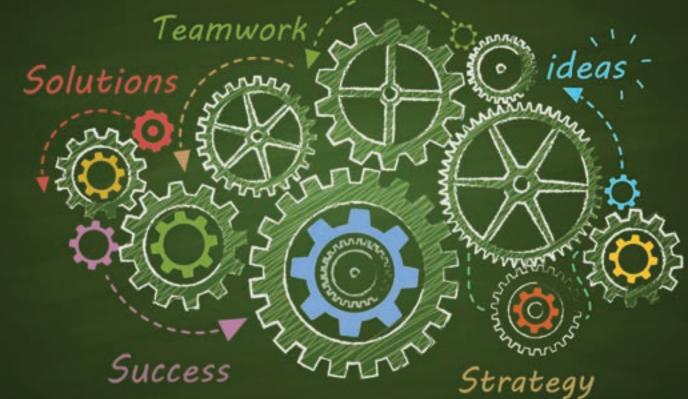
CAREER FOCUS

Strategic Skills for Scientists

Benjamin Franta discusses methods for turning what you have into what you need to get what you want.

Scientists are used to acquiring new skills—for example, learning how to use a new characterization tool, becoming fluent in a new field of technical study, or developing transferable skills such as writing and public speaking. Scientists know how to do a lot of things. However, there is one skill set that is often underdeveloped in academic scientific training: strategic skills.

Strategic skills relate not to *what* a person can do, but *how* a person solves a problem. Marshall Ganz, a lecturer at the Kennedy School of Government at Harvard University (USA), describes strategy as "how we turn what we have into what we need to get what we want."

All three links of this chain—what you have, what you need, and what you want—are important. Determining what you want may be the most straightforward task. For many graduate students, it's obtaining a Ph.D. In this case, what you need may also be easy to define; it might be a set of published research papers. Determining what you have may take more thought; your inventory could include your own knowledge and research skills, your motivation to pursue various research projects, as well as your potential collaborators and mentors and their knowledge and skills.

Now, having identified the three links, you must identify effective and feasible pathways for going from what you have to making it what you need and getting what you want.

The more novel and complex a problem is, the more important strategic skills are for solving it. Imagine that you are creating a company that you eventually want to take public. This complex problem requires you to consider a vast number of people and interests in order to define what you have, what you need, and what you want. Identifying pathways to take you from

startup to stock exchange may be very challenging and there may be no clear answers.

Strategic problem-solving in science

Academic scientific training is typically focused on solving problems that others have solved before, with the goal of replicating the "right" answer in the most efficient way. In contrast, complex problems often do not have a "right" answer, and, in practice, optimal solutions to these problems are not always implementable due to political or social factors.

Complex problems may also have many variables over long, unpredictable timescales; so the linear problem-solving skills developed by academic scientific training—a leads to b, and b leads to c—are not helpful. And finally, understanding which strategies work is sometimes possible only in retrospect, years or decades later, making the pursuit of an optimal solution even more difficult.

For all these reasons, solving complex problems is less about generating the one right answer and more about generating solutions that may have flaws but nonetheless help you progress toward a goal.

How does a graduate student develop strategic skills? I suggest getting involved with an activity that develops these skills while taking care to maintain progress on your degree. Over the past three years I have been working with the activist fossil fuel divestment campaign at Harvard. My experience with the campaign has helped me to develop three strategic skills that I can also use in the lab:

Iterative tactics. It's important to remember that great pieces of work are built one brick at a time. Iterative tactics involve setting a clear objective toward your ultimate goal, executing that objective, assessing what has been gained or learned, and then repeating this process over and over. This skill is useful for any long-term project in which you can't lay out your entire pathway before you start working. A single experiment won't lead you directly to your Ph.D., but the outcome, even if unexpected, usually provides lessons, tools or knowledge that informs your next experiment or iteration. Unlike working on a problem set, the iterative

What experiences have helped you to develop strategic skills, and how has that affected your work as a scientist or engineer? Let us know at opn@osa.org.

method is not about hitting your target on the first try; it's about moving on a trajectory that tracks toward your target.

Consensus operation. Operating alone is not the name of the game in grassroots organizing or in most research. Consensus operation is the art of combining many people's opinions and efforts in order to develop solutions that one person cannot generate alone. It's not inherently difficult, but it isn't a skill that's often developed in formal education. Consensus solutions tend not to represent any one individual's idea of the optimal solution, and thus, require flexibility on everyone's part. Further, consensus-built solutions are not strictly "better" than individual solutions. However, the use of consensus allows for progress to be made when an individual would have hit a dead end; it guards against blind spots and sometimes provides surprising resources or insights.

Moving forward in any context. This skill is about identifying resources and opportunities even in tough times. In research, it's not uncommon to think, "I could make a lot of progress, if only …," with the roadblock being a temperamental laser or a temperamental advisor. To move forward in these tough times, assume that the problem won't go away and identify ways to make progress under suboptimal conditions, even if that progress isn't what you initially envisioned. The key is not to get stuck. If you don't get stuck, chances are you'll find a way to progress toward your goal. You may even discover a better goal along the way.

Try developing these strategic skills in the lab or, better yet, in a context in which you are forced to learn as you go: starting a student group, organizing a conference or workshop, or even creating a startup company. These challenges all task us with turning what we have into what we need to obtain the outcomes we want. And just like any other skill, there is no substitute for learning by experience. OPN

Benjamin Franta (bafranta@fas.harvard.edu) is a Ph.D. candidate in applied physics at the Harvard School of Engineering and Applied Sciences, USA. He is also a research fellow at the Belfer Center for Science and International Affairs at the Harvard Kennedy School of Government.