SCIENCE & DIPLOMACY

A quarterly publication from the AAAS Center for Science Diplomacy

AAAS

Mandë Holford and Rodney W. Nichols "The Challenge of Building Science Diplomacy Capabilities for Early Career Academic Investigators," *Science & Diplomacy*, Vol. 6, No. 4 (December 2017). http://www.sciencediplomacy.org/perspective/2018/EACIs

The Challenge of Building Science Diplomacy Capabilities for Early Career Academic Investigators

Mandë Holford and Rodney W. Nichols

Science and technology intersect with economic, environmental, and societal goals in ways that are increasingly recognized internationally to be vitally important. At the same time, the internet and digital innovations have created extensive paths for the next generations of scientists, technologists, and engineers to share findings and breakthroughs with colleagues all over the world—helping overcome obstacles of nationality, culture, and language.

These trends make it an apt time for early-career scientists to learn about the opportunities at the intersection of science and diplomacy to positively influence policies and the global commons. However, "science diplomacy" as such is not yet taught with the same rigor and energy as other concentrations or degree programs housed in traditional schools of diplomacy and foreign affairs. How can early-career scientists, technologists, and engineers gain the education and training they need to shape policies that govern not only S&T endeavors but also socioeconomic agendas around the world? The challenge is clear: how do we advance science diplomacy capabilities through educational curricula, training, and experiences that couple knowledge of real-world international affairs with the detailed expertise that comes from undergraduate and graduate education in STEM fields?

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In the private sector and government, the need to formally train early-career professionals in global affairs is much less pressing because many young professionals gain heightened awareness of worldwide activities outside their specialties through their daily work. They learn on the job and occasionally get leave for continuing education. In particular, early-career foreign service officers receive education on a continuing basis: they must pass a rigorous entrance exam and then benefit from periodic training over many years as they move from post to post. However, early-career academic investigators (ECAIs)—which include PhD students, postdocs, and not-yet-tenured STEM faculty—generally need a nudge. While science is a global enterprise, most ECAIs have little background in international affairs and generally lack an understanding of science diplomacy (SD).

To address this need, several institutions have started new programs. For example, the Center for Science Diplomacy at the American Association for the Advancement of Science (AAAS) recently launched an online science diplomacy course[1] that provides an hour of introduction into the field. At the university level, the Fletcher School at Tufts has created[2] and graduate students in New York City can attend a course at the Rockefeller University[3] taught by the authors that provides an introduction to SD. These are promising developments.

However, to make these pilot efforts more significant—perhaps even scalable to the level of degree programs—they must be made rigorous and include a robust curriculum that provides a foundation of knowledge and experience that can be scaffolded as students advance in their careers. This piece outlines bedrock knowledge-building areas for training such as immersive experiences through simulations and role-playing, courses in foreign languages and requirements to improve communication skills, and an introduction to international institutions and issues (global governance).

Conceptual Framework

Our recent Editorial in Science outlined how both the enterprise of science and the reach of diplomacy are enhanced when these activities are partnered in solving global issues.[4] Using the typology recommended by the British Royal Society and AAAS in their 2010 report,[5] the term SD typically covers three functions:

1. Scientists, or engineers or physicians, advise diplomats on issues wherein S&T is relevant, as often occurs when negotiating intergovernmental agreements on topics such as sharing weather data, monitoring air traffic control, controlling arms, or alleviating medical or urgent environmental threats.

2. Diplomats pave the way for cross-border efforts by scientists, such as collecting samples for research, gaining entry for extended joint activity at special sites, and facilitating educational opportunities.

3. Selected initiatives are designed to spur cooperation and dialogue among scientists whose individual home countries are in conflict, perhaps yielding diplomatic benefits in addition to advancing science. A dramatic current example of this third idea is the participation of physicists from Iran, Israel, the Palestinian Authority, and other Middle East nations in Jordan's Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME).[6]

These three functions are often intertwined, with SD commonly occurring in complex situations in which actions may be carried out on national, regional, or international levels, and may encompass scores of stakeholders. Given this conceptual background, essential components for training ECAIs in SD are as follows:

1. *Simulated Experience*

Just as Model UN and, more recently, Model Diplomacy,[7] an initiative of the Council on Foreign Relations, have provided simulated play experience for students and foreign affairs officers, SD training for ECAIs must have a quasi-experiential component. The obvious analogy likewise emerges of pilots learning from flight simulators to establish a firmer, hands-on base for their first actual flights. ECAIs, in turn, need simulators to hone their academic skills for a policy setting.

Past cooperative encounters between scientists and diplomats can be used as case studies. Drawing from such experiences, ECAIs can role-play in order to identify the boundaries and optimal conditions for applying their scientific expertise. As scientists and engineers being asked to provide expert information, ECAIs must learn to distinguish among advising, advocacy, and activism. Role-playing reveals the ambiguities, trade-offs, and competing interests at play in these disparate actions. This divide is too often blurry, especially when strong technical and political views collide.

Participation in traditional war games or cutting-edge virtual reality simulations offers rich opportunities for critical thinking and knowledge building. A gold standard on the diplomacy front is PeaceMaker,[8] a game in which players are either Israeli or Palestinian governmental officials who work through real-world scenarios, looking at actions and reactions from many points of view. In this compelling game, decisions have consequences as the players try to negotiate toward a solution to the Israeli-Palestinian conflict. Similarly, SD learning games could be developed that combine—and test—both the sociopolitical and technical skill sets essential for effective science diplomacy.

An early example of an SD learning game is the Mercury Game,[9] developed by Leah C. Stokes, Noelle E. Selin, and Lawrence E. Susskind at the Massachusetts Institute of Technology. The Mercury Game conveys the intricacies involved in communicating scientific findings while forming policies concerning environmental treaty negotiations. Using the findings in the The United Nations Environment Programme's (UNEP) Chemicals Branch 2002 Global Mercury Assessment to set up simulated role-playing scenarios for scientists, students, and policy makers, the game takes place at an implied policy hearing where representatives from North and South nations, NGOs, and industry come together to devise policy for regulating the limits on mercury in food, artisanal products, and industrial output.

Both PeaceMaker and the Mercury Game succeed because they fit the traditional definition of a game—i.e., a competitive form of play with defined rules and a result decided by skill, acumen, and luck. Every game has a "winner," and when ECAIs take on roles, they shed their own identify and adopt a different decision-making perspective in order to win. According to PeaceMaker's rules, a player triumphs by achieving an agreed two-state solution to the Israeli-Palestinian conflict; in the process, players become empathetic to the suffering and challenges on both sides and learn to compromise toward achieving a desired end goal. As for the Mercury Game, it demonstrates the full spectrum of advice, advocacy, and activism. The most convincing players, in their roles as NGO professionals, industry representatives, or country officials, are those who wholeheartedly embodied their role in seeking to win. Indeed, they even present arguments with which they might not agree professionally outside the terms of the game. PeaceMaker and the Mercury Game thus show how powerful hybrids of mental agility, professionalism, cultural sensitivity, and empathy are needed to reach effective, science-informed responses to today's global challenges, for which diplomatic negotiations are usually the best solution.

2. Languages and Communication

Major components of diplomacy include careful listening, attentiveness to nuance, and responsiveness to tone. Indeed, one of the best ways to develop cultural sensitivity is to learn another language, which allows the learner to anticipate the goals and motives of counterparts. To this end, ECAIs interested in SD should be required to learn a non-native language. Many ECAIs are already well along this path, learning languages as part of their lives and graduate career development.

ECAIs interested in SD also must learn to translate their specialized knowledge into crystal-clear terms that can be understood by and resonate with policy makers. The importance of such work was especially vivid in negotiations with the Group of 77 at the 1979 UN Conference on Science and Technology for Development, which one of the coauthors (Nichols) witnessed firsthand. Linguistic limitations in several delegations made it more difficult, for instance, to explain some components of technology-transfer mechanisms. Happily, most of the participants spoke excellent English; thus, the lost-in-translation gaps were few. The lead State Department officer, Ambassador Thomas Pickering, was gifted in bridging any such gaps. Nonetheless, this conference, consisting of several thousand people, illustrated not only the barriers created by the lack of a common language but the corresponding requirement to find translators across disciplines, from engineering to economics.

Goals for diplomatic action often cross several fields in the natural and social sciences, requiring a different kind of translation. An ECAI's skill set in quantitative analysis can help portray the ideas and stakes in highly specific ways, such as levels of risk in handling hazardous materials. Because statistical analysis is not often among the strengths of career diplomats, ECAIs can help frame clearer options, as well as delineate the range of uncertainties in a concise manner.

Precise communication and empathy are crucial in conducting broad negotiations, in which conflicts inevitably surface, and even in the ostensibly simpler task of charting realistic timetables for collaborative projects. While lab research is often solitary, global efforts thrive only with openly designed partnerships founded upon mutually agreed terms, along with exit options. ECAIs know this well in their individually conceived cooperative projects, and they can undoubtedly transfer such wisdom to global challenges.

Another large domain demanding effective SD communication is the public. Few ECAIs are experienced in talking to the public, much less in shaping sound public understanding of the choices at stake in SD. Yet we know from Nobel Prize winner Daniel Kahneman's brilliant work that most people, most of the time, are slow to apply logic in their thinking.[10] Instead of deliberating slowly and carefully, people tend to react quickly, intuitively, and emotionally when confronted with new choices. Accordingly, for ECAIs to be effective in informing the public, they need brief, convincing points backed up by confirmations from trusted authorities. ECAIs must not only learn the evidence, they must also practice how to communicate it to a general, wary, and hard-to-reach lay audience.

One pertinent example involves verification of agreements limiting nuclear weapons. This subject is complicated by both the physics and engineering and by the politics and economics surrounding the implementation of agreements. Nuclear negotiations have been classic illustrations of the combination of complex science with persistent diplomacy. Spanning the 1960s until the present, talks have ranged from U.S.-Soviet summits to multilateral meetings about North Korean and Iranian arms. The challenges to public understanding have been formidable. During the mid-1980s, one of the coauthors (Nichols) chaired an AAAS Board committee overseeing an initiative to reach the public and explain what verification means, how it works, and why it could fail when one party cheats. A resulting publication underscored that a central purpose of verification is "to promote public confidence in arms control agreements."[11] Recently, the Federation of American Scientists contributed to the same goal by examining how "public technical means"[12] can clarify verification of the Iran nuclear deal.[13]

To succeed in international activities, ECAIs must speak to the public. One effective route to improving public communication skills is through giving volunteer seminars on research at a local library, museum, school, or senior center. Such offers to share knowledge and discuss contemporary technical topics are rarely refused. Requirements for such activity belong in any curriculum, just as apprentice teachers must serve as externs in classrooms.

3. International Institutions and Global Knowledge

Compared to daily life in the research lab, international institutions and global governance can feel like sprawling, distant, and often opaque subjects. To navigate international affairs, ECAIs need a syllabus sufficient to gain both knowledge and confidence regarding these subjects.

In the six-week elective SD seminar that the authors co-teach with Jesse Ausubel at the Rockefeller University, many gifted ECAIs have little or no background on the most prominent international institutions that depend upon S&T, such as the World Health Organization (WHO), International Atomic Energy Agency (IAEA), and UN Development Programme (UNDP). These ECAIs have had little formal education in economics, international history, demography, or geography. Instead, and understandably, they have been totally immersed in their own fields—such as biochemistry, genetics, neuroscience, biophysics—throughout college and graduate school. The students rapidly develop a wider perspective as they explore science-based global horizons. In little time, they see more clearly the shared interests nations possess in future trends such as health, internet privacy, or water scarcity.

Using her research in marine biodiversity and drug discovery to exemplify the need for learning about global governance, one coauthor (Holford) outlines for the class the challenges of collecting the venomous snails she studies, which are found in tropical marine environments, typically nations in the southern hemisphere that have underdeveloped S&T capacities. Conducting biodiversity research requires careful and at times sensitive discussions concerning conservation of natural resources, cultural awareness, and economic trends. This work entails many governmental checkpoints, such as identifying in-country collaborators, officials in ministries of science, agents who approve import/export permits, as well as the authorities responsible for establishing intellectual property agreements and terms of use. Young investigators are rarely taught how to navigate such road bumps, but such skills are pivotal in biodiversity careers and a central part of science diplomacy.

It is, of course, impossible to acquire "global knowledge" on the cheap. One striking way to begin to account for issues across the world is with maps.[14] Migrations, natural disasters and their subsequent effects, trade routes, and other international links are just some examples that can come to life on a map. Japanese architect Hajime Narukawa created the AuthaGraph world map,[15] which illuminatingly uses design principles to frame various perspectives on national boundaries.

In addition to reading, mapping, and debating choices on major science-oriented global choices, ECAIs should consider an internship at a national or multinational organization located outside their home country or place of work, e.g., the United Nations, U.S. Centers for Disease Control, a local mayor's, or a governor's science liaison office. Internships are a path to obtaining "real world" experience about S&T-based international issues and practices.

Another option for ECAIs to gain experience in international practices is through fellowship programs. One of the coauthors (Holford) is a former AAAS Science and Technology Policy Fellow,[16] who after getting her PhD from the Rockefeller University spent a year in Washington, D.C., working in the Office of International Science and Engineering (OISE) at the U.S. National Science Foundation. While at OISE, she traveled to Scandinavian and Latin and South American countries to develop or promote collaborative science programs for U.S. and foreign scientists and engineers. The experience of transferring critical thinking and analytical skills to diplomatic settings—in meetings with ministers of science and even royalty, in the case of the Queen of Norway—was transformative. Her fellowship tenure helped shape the scientific questions the coauthor has pursued in her laboratory, demonstrating the importance of gaining real-world exposure during her formative years as an ECAI.

The recent AAAS Center for Science Diplomacy report *Connecting Scientists to Policy around the World*[17] provides a comprehensive list of SD activities at the university and national levels. As demonstrated by the experiences of one coauthor (Holford), an SD fellowship does not mean one will leave science. An individual can be a science diplomat in parallel with continued work as an active researcher.

Building SD internships and fellowships into PhD training will require flexibility from laboratory mentors and university administrators, who often disparage the idea of a graduate student who does not commit full-time to his or her research. An institutional and community shift must occur so that mind-stretching SD experiences during graduate training are viewed as a necessary skill, similar to learning how to code.

Obstacles and Opportunities

In the United States, funding shortages constrain the global ambitions of ECAIs. Modest funding for international work, in both the laboratory and policy domains, exists at the large U.S. mission agencies, such as the National Science Foundation, National Institutes of Health, Departments of Agriculture, Commerce, and Energy, and the Agency for International Development. In such venues, the scale is small and should be increased.

Another obstacle to the development of optimal SD curricula for ECAIs in the United States involves the tendency for these courses to be U.S.-centric. SD, in truth, has been practiced for centuries— perhaps starting with the exchange of spices and materials along the Silk Road trade routes. After World War II, SD was strengthened with the creation of UN-affiliated agencies such as the WHO, and at the inaugural 1957 Pugwash Conference in Canada, where most nations aimed to limit nuclear weapons. Yet SD is still viewed in many circles as a recent American construct. This skewed perception triggers mistrust among several nations and their ECAIs. A dedicated effort must therefore be made to ensure SD curricula have authentic and well-reasoned justifications, grounded in the best evidence and open for responsible exchanges—from many perspectives—across the world. SD is defined as the process of engaging science in diplomatic practices. It is not captive to any nation's policy agenda, but rather a way to think through advancing shared initiatives, such as the 2030 UN-sponsored Sustainable Development Goals (SDGs).

The SDGs, in fact, constitute one of the most significant new examples of the rapidly expanding opportunities for science in diplomacy, and diplomacy for science. In 2015, a Sustainable Development Agenda was embraced by countries around the world to protect our planet and build prosperity. Seventeen ambitious goals were identified, ranging from ending poverty and hunger to fostering sustainable economic growth and building peaceful, just, and strong institutions. S&T expertise is at the core of pursuing several of the agenda items. These SDG objectives welcome scientists, physicians, mathematicians, technologists, and engineers to work with governmental officials to refine and execute the SDG agenda. Success will come more readily as the S&T community participates at the local level as well as in global cooperative initiatives.

Opportunities also are growing for ECAIs to demonstrate the global skills required for employment in the private sector, in government, and in nonprofits. Several ECAI graduates from the Rockefeller University and City University of New York Graduate Center who took our Rockefeller SD course have ended up in such jobs in recent years. They did not "abandon science," but instead decided to adapt their deep intellectual base and their international aptitude to forge new roads in science engagement.

Further opportunities are increasing, if slowly, in the scores of public-private projects cosponsored by private philanthropy, such as at CRDF Global in the United States and at various national academies worldwide. Further, less-developed countries are swiftly expanding their aspirations for strong ties between the research and policy groups in their countries. Jobs usually follow such aspirations.

Conclusion

Creating curricula combined with real-world experiential training to educate ECAIs for the international arena will be complex, likely filled with trials and occasional failures. For the immediate future, universities and institutions must design more-structured programs to replace the current array of thin, sporadic ad hoc efforts.

The underlying case is clear: as former U.S. secretary of state George Shultz put it, "The revolution in communications, energy, environmental sciences, and other aspects of science and technology has...imparted an importance to S&T considerations in foreign affairs undreamed of generations ago."[18] This awareness is growing around the world.

To leverage existing collaborations in scientific research and in foreign-affairs, and to create new ones, all nations need to experiment more in educating ECAIs in science diplomacy.[19]

Endnotes

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19. We thank the Hurford Foundation for its support to the Rockefeller University's Hurford Science Diplomacy Initiative.

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