

INNOVATION

Driving Convergence with Human Diversity



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Citation:

J. M. DeSimone, C. L. Farrell, Driving convergence with human diversity. *Sci. Transl. Med.* **6**, 238ed11 (2014).

10.1126/scitranslmed.3004486

THOSE OF US WHO PARTICIPATE IN CONVERGENT RESEARCH APPRECIATE THE DIFFICULTY of its execution. In science and technology, the term “convergence” is often used to characterize an integration of knowledge from the life, physical, and engineering sciences (1–3). Yet beyond the research itself, scientists face challenges related to our entrenched professional structures for education and training, funding, hiring, promotion and tenure, and equipment and facilities use. Because these complex issues are not associated with any particular discipline, it seems prudent to fuse diverse perspectives in order to advance the dialogue around improving the infrastructure for convergent science. A recent report from the National Research Council (NRC) (4) makes recommendations for addressing these structural barriers to convergence—barriers that might discourage individuals from participating in convergent research. The release of this report also provides an ideal opportunity for considering what we have learned about the power of diversity and how we might use this knowledge in discussions of convergence as a conceptual framework for problem-solving and innovation in the 21st century.

As scientists, we may be doing ourselves a disservice by not being more deliberate in engaging nonscientists in conversations about convergence. History shows that the most innovative solutions often arise from diverse teams composed of talented individuals with different areas of expertise, backgrounds, and life experiences. In the early 1990s, one of us (J.M.D.) was asked to participate as a guest external consultant on an “Innovation Committee” for a large chemical company. When we introduced ourselves, it was immediately evident that not only did everyone look alike (all white males), but almost all graduated from the same two research programs. Everyone knew the same things; everyone approached problem-solving in similar ways. The group’s homogeneity (a reflection of its lack of both functional and identity diversity) supported insularity, and it was difficult to break into the conversation as an outsider. Because of the way it was organized, the group was at a structural disadvantage for driving innovation. Had diversity been valued in forming the group and as part of the group’s culture, the committee may have been more effective in achieving its mission. Instead, this was a lost opportunity for innovation.

We learn the most from those we have the least in common with. Diversity that arises from ethnic, cultural, socioeconomic, professional, and experiential differences forms fertile ground for innovation. A successful scientific endeavor is one that attracts and cultivates diversity, draws upon its breadth and depth, and thrives on the creativity it sparks. Merging the talents, knowledge, perspectives, and experiences of dedicated and varied individuals provides an advantaged framework for problem-solving. Harnessing human diversity effectively can have major implications for the advancement of science and society. Thus, although convergence has been billed mainly as an integration of diverse disciplinary expertise from the life, physical, and engineering sciences, there is also the human factor to consider: how to leverage diversity among participants themselves.

The influence of diversity in group problem-solving has been demonstrated broadly in recent years. For example, in his book *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies* (5), Scott Page, professor of complex systems, political science, and economics at the University of Michigan, reported that “diverse groups of problem solvers—groups of people with diverse tools—consistently outperformed groups of the best and the brightest.” This highlights diversity as a fundamental driver of innovation and suggests that it is advantageous to emphasize both ability and diversity as crucial factors for effective group problem-solving.

One percolating viewpoint is that although brilliant or unconventional ideas may come from individuals, innovation is a social process that requires diversity. Thus, in a convergence model, it would be beneficial to factor in human diversity when convening groups around a common challenge, whether focused on energy, health and medicine, big data, nanotechnology, water safety and security, or any number of complex areas that know no disciplinary boundaries. Yet, this does not mean a striving toward consensus. Friction of one

sort or another inevitably arises in any social process. One must take advantage of it, placing value on dissenting viewpoints and drawing insight from dialogue that arises when conflicting ideas converge. An emphasis on diversity generates power for a group of problem-solvers.

The new NRC report (4) emphasizes the need for better national coordination on convergence and encourages improvements to academic incentive structures, education and training programs, and funding approaches to support the convergence framework. Just as the convergence framework inherently recognizes the importance of drawing on diverse disciplinary expertise in problem-solving, we must also recognize the importance of bringing new voices—and a broader diversity of perspectives—into a dialogue about improving the structures in which we operate as professionals in the first place. It is taking a lesson from convergence itself.

Already, there is strong momentum for structural changes to enable convergent research efforts to flourish. For example, federal agencies such as the National Institutes of Health (NIH) and the National Science Foundation (NSF) have implemented policy changes to permit multiple principle investigators on grants, reflecting the type of cultural shift needed to achieve a sustainable infrastructure for convergence. Further, the NRC report on convergence identifies the economic and social sciences as crucial for success in the translation of laboratory innovations to the marketplace, pointing to a broader conceptualization of convergence involving greater disciplinary diversity. Efforts to join scientists and nonscientists in innovation are already occurring as well, through initiatives like STEAM (<http://stemtosteam.org>), a movement aimed at coupling art and design with science, technology, engineering, and math. On an economic level, crowdsourcing may be a compelling avenue for involving diverse groups in research; resources such as InnoCentive (www.innocentive.com) provide a competitive space to pull together ideas and solutions from all fields, including business, social sciences, technology development, and policy.

As the dialogue on convergence continues to evolve, emphasizing the role of human diversity can serve only as an advantage with respect to both scientific and structural challenges. Without being intentional about human diversity, we risk detracting from the opportunity that exists to achieve innovation and societal impact through convergent science. To this end, the NRC report encourages “adopting inclusive attitudes toward diversity and using management strategies to foster diversity” (4). Although there may be no perfect formula for ensuring human diversity in groups and systems, it is important to be cognizant of the role and power of diversity in each of our day-to-day practices.

– Joseph M. DeSimone and Crista L. Farrell

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5. S. E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies* (Princeton Univ. Press, Princeton, NJ, 2007).