Joining Evidence-based Innovations with Evidence-based Dissemination

James W. Dearing

One of the benefits of an applied research funding program such as those within the National Science Foundation's Directorate for Education and Human Resources is the reading and referencing across fields of study and application of ideas from diverse literatures for common social good such as STEM teaching and learning. This benefit resonates across the articles in this issue of *Metropolitan Universities*. Chemists learn from education scholars and medical educators. Physicists learn from chemists and math education researchers. Education scholars learn from management scientists. Communication scientists learn from sociologists and cognitive psychologists. While specialists routinely build upon the work of others within their specialty, the present collection of articles reflects interdisciplinary sharing to a commendable degree.

In one regard, however, this collective set of scholars and those organizations that fund them face a major challenge. While interdisciplinary scholarship on the topic of STEM pedagogies are in evidence and the same can be said for the three articles concerning means of dissemination, it can also be said that scholarship-informed activity in pedagogical innovation and in pedagogical dissemination are not much conjoined.

It is my opinion that evidence-based innovation and evidence-based dissemination belong together. Here, I identify certain aspects of the four innovations and then of the three means of dissemination highlighted on the prior pages of this special issue. Then, I suggest how evidence-based innovation and evidence-based dissemination might be brought together.

Evidence-Based Innovations in STEM Education. The four pedagogies presented in this issue share commonalities. First, each of these innovations presents potential adopters with a voluntary adoption decision; these are not, for example, policy innovations that if adopted would be compulsory for instructors to implement. None are top-down (aimed at administrators or policy makers with authority over instructors) or bottom-up (aimed at students to influence instructors); they are lateral-directed innovations from faculty-creators to faculty-adopters. Each of these four pedagogies is grounded in published literature. They have been tested and shown to produce positive and valid internal results for improving student learning. Each has demonstrated advantages for STEM learning. Each pedagogy has been implemented and externally validated at subsequent schools. Each pedagogy explicates the causal reasons why it is effective. Each encourages options in implementation to enable teachers to achieve a best fit between the pedagogy as innovation and the specific instructor style, classroom capability, and academic department context. Each relies on workshops as a means of communicating its purpose and training faculty.

As innovations, POGIL, JiTT, PLTL, and Case Study Teaching have real differences, too. POGIL is a radical innovation; it espouses a philosophy of learning and instruction based in constructivism that is not normative for most U.S. faculty and teachers. POGIL's compatibility with past and current practices of most faculty and teachers is likely low. PLTL, which draws on some of the same literature, should be more compatible, while JiTT and Case Study Teaching are each considerably more compatible than POGIL with the normative beliefs of most faculty and teachers and with their behaviors in the classroom. POGIL is also a comparatively complex innovation compared to these other three. The instructor needs to learn more, philosophically and practically, to successfully implement the POGIL approach to learning. JiTT, in contrast, is very simple to grasp and almost as easy to implement. Case Study Teaching, JiTT, and POGIL require little monetary expense, while the provision of grants to implement PLTL gives us less certainty about its scalability. Lastly, PLTL seems more sophisticated than the other pedagogies in its means of dissemination. It involves multiple stakeholders all who are connected with faculty as potential levers for tipping faculty behavior in a new direction.

Evidence-Based Dissemination in STEM Education. Workshops, campus-based centers for teaching and learning, and local informal opinion leaders are three means to accomplish the translation of effective pedagogies into broad use. A commonality across these three options for dissemination is that each currently exists. Workshops are a regular part of the curricular improvement landscape in U.S. higher education. Centers for teaching and learning, under various titles, exist on hundreds of college campuses. And opinion leaders are even more ubiquitous. They are our colleagues among us, in situ. This advantage of existence is not to be taken lightly. Creating a new system or network to disseminate innovations can be expected to be time consuming and expensive.

Comparatively, these three means of dissemination are used to varying extents to spread evidence-based STEM pedagogies. Workshops are the most commonly used means to expose faculty to innovations, forming the basis for a majority of the dissemination proposals that have been funded through NSF's education directorate, though the particular learning-centered approach described by Connolly and Millar is certainly atypical and likely a considerable improvement on the usual workshop approach of "teaching by telling." Centers for teaching and learning are well positioned to serve both as information clearinghouses for alternatives to teaching and to host or co-host workshops for training purposes. Identifying, recruiting, and intervening with local opinion leading faculty is almost never done in systematic ways for the purpose of influencing other faculty decisions about innovations in teaching and learning. Yet its potential is clear if one attends to the evidence base about the key factors responsible for positive adoption decisions. The critical function of local informal opinion leaders is not the transmission of information to the skeptical faculty member, but personal influence through example setting and talking. There can be no doubt that means of dissemination such as these three can be combined to advantage—and not necessarily at added cost—for those innovation sources or change agencies that seek pedagogical improvement in STEM education. For example, social network

identification of opinion leaders can inform decisions about who should attend workshops and who—for subsequent spread to occur—should not. Centers of teaching and learning can lend institutional legitimacy and provide access to faculty for both opinion leader intervention and the offering of new pedagogy workshops.

Bringing together evidence-based innovation and evidence-based dissemination requires that we think strategically the whole way through the planning of planned change. Just as we want evidence as to the internal and external validity of the new pedagogies that we will communicate, so, too, do we want evidence in the process of communication—the means by which we will inform and recruit others to influence their near-peers in academic departments. In this way, the right innovations will be diffused, and in accelerated fashion.

Author Information

Dr. James W. Dearing tests strategies for diffusing evidence-based innovations and has published numerous articles, book chapters, and other text on diffusion of innovations. He has been a faculty member at Michigan State University and Ohio University and recently joined Kaiser Permanente, Colorado, as a Senior Scientist with the Clinical Research Unit.

James W. Dearing, Ph.D.
Senior Scientist
Clinical Research Unit
Kaiser Permanente
P.O. Box 378066
Denver, CO 80237-8066
E-mail: dearingj@ohio.edu
Telephone: 303-636-3100
Fax: 303-636-3159