DUE serves as the focal point for NSF's efforts in undergraduate STEM education. Our programs use a variety of strategies to support DUE's mission, which is to promote excellence in undergraduate STEM education for all students.

At the heart of our efforts is the CCLI program. The major goal of the CCLI program is to support efforts in colleges and universities to develop the capacity to meet the STEM learning needs of all undergraduate students—needs as diverse as the students themselves. CCLI projects define best practice in STEM education for students entering the workforce after obtaining a two- or four-year degree, continuing their formal education in graduate or professional school, preparing to participate as citizens in a technological society, or furthering their education later in life in response to new career goals or workplace expectations.

The CCLI program is a cornerstone of NSF's efforts to ensure access to high-quality STEM education for all students by fostering the identification, development, adaptation, implementation, dissemination, and assessment of exemplary educational materials, processes, and models. The program supports innovation in introductory and upper-level courses for majors and nonmajors, including both disciplinary and interdisciplinary efforts in established and emerging fields, and targets all institutions of higher education from community colleges to research universities. Dissemination is another critical aspect of the program, ensuring that exemplary materials and pedagogies reach the larger audience of STEM faculty. Finally, the CCLI program promotes the development and validation of tools and processes for the assessment of student learning, as well as the use of these instruments in diverse learning environments.

The chapters in this publication are a subset of the projects presented and discussed at the CCLI conference, *Invention and Impact: Building Excellence in Undergraduate Science, Technology, Engineering, and Mathematics (STEM) Education.* They are examples of the many successful efforts supported by the CCLI program and its predecessor programs, Course and Curriculum Development (CCD), Instrumentation and Laboratory Improvement (ILI), and Undergraduate Faculty Enhancement (UFE). The CCLI program grew out of the CCD, ILI, and UFE programs in 1996, when the three programs were combined to increase efficiency and focus. To improve the dissemination of innovations in undergraduate STEM education, a track was designed to support the adaptation and implementation of innovative educational materials and pedagogies, and the faculty enhancement program evolved into a track to support the national dissemination of innovations through faculty development. Thus, the three tracks of the CCLI program, Educational Materials Development (EMD), Adaptation and Implementation (A&I), and National Dissemination (ND), were born. In 2001, DUE initiated a new program, Assessment of Student Achievement (ASA), in recognition of the importance of student learning outcome assessment and the need for valid instruments and methodologies for assessment. In 2003, ASA became the fourth track of CCLI.

As you read through these chapters, several themes will become apparent. For example, we have seen that, more often than not, successful projects involve multiple institutions, and the power of partnerships and collaborations is clearly demonstrated by the successes outlined in many of the chapters. Similarly, there are many chapters that illustrate how multidisciplinary teams and an interdisciplinary approach enrich undergraduate STEM learning.

For any curricular innovation to be successful, we must "know what our students know." The chapter by Maki and the chapter by Heron, Shaffer, and McDermott address the importance of discipline-based educational research. The chapter by Richardson points out that knowing our students misconceptions is equally important, because these misconceptions get in the way of true conceptual understanding. As some of the chapters demonstrate, we must be mindful of what constitutes valid assessment of student learning and we must continue to move beyond student attitudinal surveys to direct and authentic measures of student learning.

Some of the chapters illustrate the richness of inquiry-based learning. Referred to as "interactive learning," "activity-based learning," or "discovery-based learning," this "learning by doing" is a powerful way for students to not only "learn about" STEM but to also "learn to be" a scientist, mathematician, or engineer. This type of learning can be woven into the more traditional classroom or instructional laboratory. It may also be infused into class-related activities that occur outside of the classroom or laboratory and use the local natural environment, integrated into a service learning that connects with the local community, or manifested as undergraduate research.

This publication serves as an excellent source of information for faculty who want to incorporate into their courses new pedagogies that have been shown to be successful. Just-in-time teaching, Calibrated Peer Review™, peer-led team learning, investigative case-based learning, and studio-style classes, such as Beichner's SCALE-UP project, are all described. Other chapters demonstrate that using web-based tools, virtual laboratories, and compiled data sets can enrich STEM learning for undergraduates. Others illustrate that visualization, such as modeling, animations, and GIS, can clarify STEM concepts and make STEM disciplines more accessible to students. Innovative laboratory design is described in chapters that illustrate how to use complex instrumentation and technology, typically found only in the research laboratory, to show how science is done and to teach the experimental method in a learner-centered way.

Creative approaches to faculty development are exemplified in a set of chapters that describe a variety of discipline-based and multidisciplinary approaches to the dissemination of curricular reform. This section describes effective ways to introduce faculty to innovative teaching methods, mentor them as they adapt the methods for their own classes, and help them seek external funding for their work. Some of the obstacles encountered in dissemination and faculty development projects are also discussed.

While the CCLI program primarily addresses the improvement of undergraduate STEM curricula, DUE and NSF are also committed to increasing the number of STEM graduates and broadening participation in STEM fields. The chapter by Ulseth describes a project designed to improve student recruitment and retention, thereby increasing the number of STEM graduates, in this case in engineering. One approach to broadening participation in STEM disciplines is illustrated in the chapter by Ellis and Andam, which describes the implementation of an engineering curriculum designed around studies on educational environments and practices that foster recruitment and retention of women. Slack and Wheatly describe an institutional-wide initiative to provide laboratory access for people with physical disabilities, sometimes referred to as the "last minority."

One of our goals in sponsoring the *Invention and Impact* conference was to facilitate cross-disciplinary sharing of new pedagogies. Workshop evaluations suggest that this goal was more than met. It is our hope that this volume will promote even further diffusion of exemplary materials and practices from one discipline to another, as STEM faculty read these chapters, learn about new pedagogical advances in disciplines other than their own, and devise ways in which they can be adapted for their own classrooms.

Rosemary Haggett
Director, NSF Division of Undergraduate Education
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