

Conference Summary

More than a year before the *Invention and Impact* conference was held, a number of discussions took place within the Division of Undergraduate Education at NSF to think broadly about our CCLI program. These discussions were inspired by Judith Ramaley, head of the Education and Human Resources Directorate at NSF. She asked us to think about how the CCLI program fit together as a whole and how we might look toward improving it. The program had been in existence for about six years and was due to be revisited. Was it meeting the broad needs of the community? Was the focus correct? Were there tangible improvements in student learning, faculty professional development, and the infrastructure of undergraduate education?

Program officers within the division agreed that on the last point, tangible improvements, there were plenty of examples. However, we knew it would be difficult to move some of these often-revolutionary improvements between the disciplines and to gain broader recognition of the widespread efforts of the community in developing innovative materials and practices. Our discussions led to the idea of this conference. We wanted to recognize and celebrate the great efforts of so many individuals contributing to these developments and also to help spread the innovative ideas between and among the various STEM disciplines. We also wanted to help build collaborations that would foster both the spread of knowledge and the construction of the next generation of ideas to improve student learning.

Although the meeting itself physically took place in the spring of 2004 (April 16–18), there were a number of components that extended beyond it in both directions to help achieve the goals we set for ourselves. To begin with, many discussions within and beyond DUE helped us shape the content and style of interaction to bring together a diverse group of educators, administrators, content developers, education researchers, and undergraduate students. The planning started in May 2003, and throughout the ensuing discussions, a number of themes emerged (and more than a few were discarded along the way). First, we wanted to maximize the interactivity of the conference so that attendees would have more than a passing acquaintance with the materials and methods presented and, consequently, would be more likely to adapt, adopt, or promote the ideas in their own institutions. Second, we wanted to help bridge disciplinary boundaries and build collaborations to enable the broadest possible sharing and cross-fertilization

of innovative ideas spawned by CCLI. Finally, we wanted to reach out to a broader community to help build recognition of both the innovations themselves and the documented successes attained by many of these projects. To help us achieve these goals, we partnered with Education and Human Resources at the AAAS to host a conference and its ancillary events and outcome activities.

Because many of us had attended numerous *non-interactive* lectures on the value of interactive engagement, we wanted to make each component as interactive as possible by asking our presenters to model this behavior in their workshops. We also limited the number of plenary sessions and scheduled many of these during mealtimes so that we could maximize participants' opportunities to share ideas. This, along with numerous parallel smaller workshops (as opposed to larger ones that are typically less interactive) and numerous networking opportunities, allowed us to bring the scale of a 400-person meeting down to small groups much of the time.

Our workshops each consisted of approximately 40 people (10 parallel sessions) of 90 minutes. Each of the four workshop periods (see the Appendix for a list of workshops and their arrangement) had a mix of opportunities for attendees to experience aspects of new development, assessment, interactive engagement, educational technology, and other innovations affecting newly developed pedagogies. We also pressed our presenters to shape their workshops for an interdisciplinary audience. In any one session, you were likely to find a collection of biologists, physicists, chemists, engineers, psychologists, mathematicians, computer scientists, and others. This mixing alone contributed positively toward our second goal of bridging disciplinary boundaries and building collaborations. We feel that the CCLI program is most effective when it can bring good ideas together with the people who can effectively implement them in the classroom and who can help spread them beyond the discipline or setting of their initial development. In the chapters that follow, many of the workshops and ideas are represented. We encourage you to contact the authors to learn more about what they have done and are currently doing and to inquire about ways that these ideas might be used in your local context. As an aid to this, the electronic version of this publication is available at <http://www.ccliconference.org>, with hotlinks on many of the workshops and posters to the original materials and their developers.

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Beyond the presenters of the 40 workshops, we also invited about 200 current or former principal investigators of CCLI grants (or their predecessor programs within DUE) to learn about other programs and to share the results of their projects. A poster area was set up so that the nearly 200 posters could be displayed throughout the entire conference. We divided up the two specific poster session times so that the authors were stationed with their posters during one of two time periods. This allowed plenty of time for interaction, networking, and exploration of the wide range of ideas. The posters were organized around major themes such as laboratory, visualization, assessment, collaborative projects, and pedagogy, with no attempt to compartmentalize by disciplines. This organization provided an effective means to highlight cross-cutting issues and projects across the disciplines for both the attendees and the principal investigators displaying their posters. The poster sessions were well attended, and everyone agreed that the organization of the posters provided dramatic evidence of the multidisciplinary, if not interdisciplinary, flavor of CCLI projects.

Although we limited the number of plenary sessions, most of them provided an opportunity to actively engage the conference attendees in some less-than-typical ways. The Appendix includes descriptions of each of the speakers; however, I will highlight one talk briefly, as we designated it as an "interactive plenary." This event came near the end of the second full day, so we knew people would need a bit of a break physically, but we wanted to continue to engage them mentally. Eric Mazur from Harvard University filled the bill with an interactive, multidisciplinary talk on perception, visualization, and research on how and what students view in textbook illustrations. We also asked Eric to include an interactive element using a set of 400 Personalized Response System wireless "clickers" to help involve audience members in the details of his presentation. This provided the audience a chance not only to actually use the technology (a significant learning experience), but also to witness ways in which it can be used effectively to engage people in a large lecture environment. Eric has championed the use of this technology and associated concept tests in this type of environment in his Peer Instruction methods (portions of which have had CCLI support). You can view Eric's presentation at http://mazur-www.harvard.edu/talks/pdf_files/Talk_530.pdf.

One other interactive feature of the conference was a pre-conference activity in the form of participatory discussions

using listserv groups. A more complete description of the details of this can be found in the Appendix. This communication venue allowed us to pose questions relevant to the development of materials and methods and also to solicit comments from the community regarding the CCLI program itself. This, along with a Sunday morning breakout session, provided us with supporting evidence of the successes of CCLI funding. The conversations also touched on areas of importance that, as a division, we were able to carry forward to future discussions of the CCLI program.

Our third goal beyond interactivity and cross-disciplinary mixing was outreach. You are reading (in a previous era, we might have said "holding," but because this is available electronically, we can no longer make that assumption) one aspect of this effort, but another took place the day before the conference when the AAAS sponsored a Capitol Hill event to help inform the U.S. House and Senate staff members (often the people who actually write laws) of the results of funding education projects through CCLI. We assembled a group of eight CCLI principal investigators and their students to talk with staffers during a lunch on the day preceding the start of the conference. Many of these individuals went on to meet individually with their representatives or their staff later that same afternoon.

Further outreach occurred through parallel publication of some of the chapters in this book in other public venues such as the CUR (Council on Undergraduate Research) Quarterly and the American Physical Society Forum on Education newsletter (<http://www.aps.org/units/fed/newsletters/summer2004/paula.cfm>). Our aim was to reach as broad an audience as possible to expose the ideas to as many people both in and across the STEM disciplines.

It was also an aim throughout the planning of the conference to invite as diverse an audience as possible and to include diversity not just in the usual sense, but also in ideas, experience, and background. This was one of the big strengths of the conference. The result was a number of comments like the following:

"I also wanted to comment on how useful this conference was. There are two courses we'll be teaching here this coming fall that will be significantly changed as a result of contacts made during this conference. It was extremely useful to be able to see work done by others under the auspices of NSF funding and to talk with the people doing the work to

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see how their ideas might possibly fit into what I'm trying to do in our department. I think the conference was a huge success."

"I thought the conference was excellently conceived and planned. Bringing together an interdisciplinary group to consider the questions you raised really worked. Aside from the important larger issues, I was able to meet some very brilliant individuals from other disciplines such as economics and physics and look forward to some further interactions with them as well. As was apparent in our break-out group Sunday, interdisciplinary interactions will be of growing importance in undergraduate education."

One well-known education researcher told us before the conference that such events were a waste of time because they are too broad and unfocused. At the end of the conference, the same individual came back and related that it was one of the most valuable conferences he had attended. In the end, however, it is measurable effects, not anecdotes, that demonstrate the value of such an event. To this end, we set out to determine the degree to which the ideas were spreading beyond the conference itself. Through the AAAS, we are conducting a small evaluation/research effort to 1)

determine the degree to which the ideas have spread via surveys and phone interviews and 2) measure the degree to which the "interactivity" of a workshop session affects its dissemination. We believe that getting students to "do" as opposed to merely "listen" improves their comprehension of a subject. We hope to show, in a small way, that the same applies to dissemination of ideas in venues such as this.

So, what next? The Division of Undergraduate Education has committed to holding a conference similar to this on a semiregular basis (perhaps every two to three years). The next event is likely to continue to cross STEM disciplinary lines, but may either be broad or, as has been suggested, focus on a particular area such as assessment, education research, introductory courses, or active engagement. The NSF and our division rely on the community to inform us of the best ways to help spread good ideas, materials, and methods. We look forward to hearing from you on your ideas for new directions and ways to get them to a broad audience.

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