Creating Research Rich Curricula to Enhance Student Learning

Council on Undergraduate Research
Transformations Project
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> We are deeply grateful to the faculty and administrators from your campus who are contributing to and serving as national leaders in this enterprise. They are truly advancing STEM education and student success on their own campuses as well as nationally.

The CUR Transformations Project, now in its fourth year, is an NSF-funded project with far-reaching implications for STEM (Science, Technology, Engineering, and Mathematics) student success. This document provides a brief synopsis of the progress made thus far toward project goals and why the work of those involved at your institution is at the forefront of national efforts to incorporate more research-centric practices into curricula and departmental cultures.

CUR Transformations is funded by the NSF as a national model project through the Division of Undergraduate Education (DUE) Improving Undergraduate STEM Education (IUSE) program. It involves 24 departments at 12 institutions that are engaged in a long-term effort to develop research-rich curricula and cultures in biology, chemistry, physics, and psychology. The 12 institutions involved in the project were selected through a rigorous three-phase application process from close to 90 institutional applicants. Your institution was selected from a highly competitive pool and is a valued partner in our leading-edge efforts.

Each department works with two expert consultants who coach them in shaping and implementing their monthly and yearly project goals. All project participants meet at least once a year. The project has two main goals:

1. Developing new undergraduate curricula that are backward-designed from degree learning outcomes and that vertically scaffold research experiences across the full span of the undergraduate curriculum.
2. Uncovering new research knowledge on student learning, departmental culture, and institutional change.

This is a significant and timely project (and NSF has highlighted our project in IUSE presentations) as no other NSF-funded groups are working to modify curricula and culture in these substantial ways. Faculty and administrators at your institution are creating new and innovative approaches of engaging students in biology, chemistry, physics, or psychology disciplines. The impact of this project will be substantial and affect thousands of students and hundreds of faculty members across the country. As we are engaged with the creation of this new way of interacting with our students and our disciplines, the project participants serve as national leaders as they move this work forward and share it broadly with their academic and disciplinary communities.

So why are members of your institution's faculty and administration, project consultants, and principal investigators (PIs) thoroughly committed to this project?

One reason is that we all believe that there are better ways to teach and for our students to learn. Also, undergraduate research and allied high-impact practices have been shown to have numerous positive outcomes for students and faculty. And these positive outcomes are especially true for students from underrepresented groups who become involved in these activities.

Some of the outcomes of the project to date include:

- Revising learning outcomes for entire degree programs;
- Vertically scaffolding the curriculum to reach the learning outcomes, often resulting in comprehensive change to most degree coursework;
- Trimming excess/redundant coursework and reemphasizing skill-building throughout curricula;
- In some cases, all courses now provide students with a research component, including engaging students in online research;
- Creating community and facilitating decision-making within targeted departments;
- Connecting with colleagues outside the targeted departments;
- Co-hosting of backward design and other professional development workshops;
- Initiating and/or increasing assessment practices within departments; and
- Substantial numbers of presentations and publications detailing the project.

Undergraduate research is known to increase student retention and other dimensions of student success. In the challenging financial times in which we are now living, the relatively modest cost of creating this new curricular world has deep payoffs for students, faculty, and institutions. What we also have observed at the institutions involved in this project is appreciable enhancement of the intellectual climate in the departments and a robust embrace of the concept of shared departmental curricula and decision-making. The PIs are in the process of developing a Theory of Change Model that will illuminate what the primary factors are for transformational change to occur in a project such as this one. Our preliminary results have recently been published:

Malachowski, Mitchell R., Jeffrey M. Osborn, Kerry K. Karukstis, Jillian Kinzie, and Elizabeth L. Ambos. 2020. Scaffolding research into undergraduate STEM curricula and cultures: An emerging model for systemic change. In: White, K., Beach, A., Finkelstein, N., Henderson, C., Simkins, S., Slakey, L., Stains, M., Weaver, G., and Whitehead, L. (Editors), *Transforming Institutions: Accelerating Systemic Change in Higher Education*, pages 59–69. Pressbooks. (http://openbooks.library.umass.edu/ascnti2020/)