

SYSTEMIC CHANGES IN THE CHEMISTRY CURRICULUM—FULL GRANTS

A Workshop Chemistry Curriculum

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Chemistry Initiative

The City College Consortium, which includes ten senior and community colleges at the City University of New York, and the Universities of Pittsburgh, Pennsylvania, and Rochester, is developing and applying widely a new model of teaching. This model, called Workshop Chemistry, introduces participation and mentorship by recent completers of the course. Small group, student-led workshops are integral to the course structure. Each week two workshops of one hour each complement the lecture and laboratory components. The workshop model provides a collaborative learning experience that increases student involvement and provides a new role for students as mentors. In Workshop Chemistry, students learn the problem-solving, communication, and teamwork skills crucial for success in the workplace, while learning chemistry more effectively. A prototype workshop model has been developed at City College in a general chemistry course for science and engineering majors, and is being expanded and refined for a broad range of courses including preparatory chemistry, chemistry for allied health sciences, organic chemistry, instrumental, and analytical chemistry. The experience of students as workshop leaders provides a natural introduction to teaching that is being formalized through a Teacher Preparation component of the project. The workshop method is also being exploited and applied in curricula for technician training, an initiative relevant to Advanced Technological Education. The project evaluates Workshop Chemistry and disseminates it beyond the bounds of the consortium. Student workshop manuals that include the problem-solving, model building, and simulation activities of the workshops are being produced for each course. New project partners will be invited to view workshops, to participate in faculty developments, and to implement pilot workshop courses at their own institutions.

Establishing New Traditions: Revitalizing the Curriculum

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FY 1995 \$ 949,968
FY 1996 \$ 899,999
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Chemistry Initiative

This project establishes new traditions in the chemistry curriculum that optimize opportunities for all students to learn chemical facts and concepts, develop and pursue interests in chemistry and chemistry-related disciplines, and appreciate how an understanding of chemistry is important to life and living. The goal is to change fundamentally the ways students, faculty, and

administrators view their roles and create a student-centered, active-learning emphasis. Addressed are five main areas that apply to all levels of the curriculum: student-focused active learning; inquiry-based/open-ended laboratories; interdisciplinary course clusters to create learning communities; a topic-oriented curriculum; and information technology/computer tools. Each development in each area is carefully evaluated, and only the best survive. Evaluation provides important information about the process of transfer of innovations among institutions of different types. To insure that the reforms planned are useful for all students, the consortium includes industry, public and private four-year institutions, minority institutions, and two-year colleges. The project gives special emphasis to students who choose teaching as a career option by mainstreaming these students in courses which benefit them in both content and pedagogy. Students, including those in Science Education, are fully integrated in the development and implementation of the project, working on both research topics and evaluation. The project also gives special emphasis to community college students in Advanced Technological Education (ATE) programs to ensure that they are given the newly developed curriculum. The students in the ATE program will clearly benefit by being provided the five main areas of thrust that this coalition is developing. All the students are expected to emerge with greater comprehension and better retention of chemical knowledge, improved ability to apply chemical concepts to new problems, enhanced appreciation of the relation between chemistry and other disciplines, and skills that enable them to work effectively in multidisciplinary teams.

ChemLinks Coalition: Curricular Reform Using Thematic Modules to Change How Undergraduates Learn Chemistry

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The ChemLinks Coalition is changing the way students experience the first two years of the undergraduate chemistry curriculum. Those “gatekeeper” courses enroll the vast majority of students who take chemistry, whether as a general education requirement, as a supporting course for another major, or as part of a chemistry major. Students must understand that chemistry is not a set of abstract and unrelated concepts to be learned; instead, it provides an intellectually challenging process for asking and answering questions related to their interests and to the needs of society.

This project is developing and testing modular materials about chemistry and the environment, chemistry and technology in society, and the molecular basis of life. With these modules, designed for students and faculty to use in a variety of institutional settings, the way students learn chemistry is being changed by challenging them to formulate and solve real problems using active and collaborative learning strategies. By treating real, interdisciplinary problems of interest to students, scientific literacy for all students (both science and non-science majors) is

promoted and the importance of science to society is demonstrated. Providing a model for students preparing for careers in teaching will have an impact on teacher preparation programs.

To change how students learn, the way that faculty teach and test must be changed. Many faculty need to become aware of significant educational innovations now underway—and of their efficacy. Even those who are aware of and committed to reform may be isolated. To achieve systemic change, individual and institutional barriers to reform are being identified and support is being provided through the Project Kaleidoscope national network. To disseminate the results and lower the barriers to curricular reform, the PIs are providing tested modular materials and new pedagogical approaches that can be adapted to local needs. Regional workshops train faculty to use the new approaches. Publications and presentations at regional and national meetings provide visibility and generate support for reform.

Project assessment documents the process of developing curricula, changing pedagogies, and institutionalizing change. It also records student reaction to those changes and the effects they have on student learning.

The ChemLinks Coalition of liberal arts colleges (Beloit, Carleton, Colorado, Grinnell, Hope, Kalamazoo, Knox, Lawrence, Macalester, Rhodes, Spelman, St. Olaf, Wooster) and research universities (Chicago, Washington-St. Louis) already has experience working collaboratively on chemistry curricular reform. Through collaboration with the Modular Chemistry Coalition of large public institutions and Historically Black Colleges and Universities, with the Advanced Technology Environmental Education Center's coalition of two-year schools, and with Project Kaleidoscope, the models and materials being developed, tested, and disseminated involve a large and diverse group of schools in making systemic and sustainable changes in undergraduate chemistry education.

Sweeping Change in Manageable Units: A Modular Approach to Chemistry Curriculum Reform

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	Chemistry Initiative

The purpose of this project is to develop new curricula, materials and methods to enhance the appreciation and learning of science, especially chemistry, for every undergraduate student so that all college graduates will command the knowledge and skills necessary to permit continued learning, lead productive lives and make informed decisions. To accomplish this mission, this project is developing and evaluating a modular approach to teaching chemistry in the first two years of the undergraduate curriculum. Modules of one to four weeks present fundamental chemistry to students in the context of a real-world problem or application and emphasize the links between chemistry and other disciplines. In collaboration with the ChemLinks Coalition, modules are being developed, tested and refined at the two- and four-year colleges and research universities comprising the two consortia. Curriculum materials, including text, lab, and multimedia components suitable for students from diverse cultural and ethnic backgrounds and usable at a

wide variety of undergraduate institutions are being produced and distributed by an established publisher. Teaching methods which utilize current understanding of learning processes and emphasize active learning and the full spectrum of modern technologies are being supported, tested and promulgated. A model support infrastructure for development and assessment of new materials and methods is being provided. A framework for continuous improvement of curricula should result from the work and be institutionalized within the consortium. Faculty workshops and sessions at national and regional meetings are being conducted to guarantee dissemination. An overall evaluation plan is in place to test the effectiveness of the new approach and its effect on student learning and appreciation of chemistry, changes in faculty approaches to teaching, and overall science literacy.