

MATHEMATICAL SCIENCES AND THEIR APPLICATIONS THROUGHOUT THE CURRICULUM

Mathematics Across the Curriculum

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| | Mathematics Initiative |

A thorough integration is being conducted of the study of mathematics with courses in physics, chemistry, geology, biology, social science, economics, art, music, philosophy, computer science, architecture, medicine, engineering, and literature. Engaged in the project are faculty representing these disciplines at a large number of institutions. Materials are being developed that are designed for use in conjunction with other texts, as independent reference materials, and as a basis for interdisciplinary courses. Support materials for faculty, including documented software, online materials, and videotapes, are being developed. The project is expected to result in fundamental changes at the institutions involved in the project. In addition, through the materials being developed and a series of intensive summer workshops, the project will benefit faculty and institutions other than those directly involved in the project.

Middle Atlantic Consortium for Mathematics and Its Applications Across the Curriculum

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| | Mathematics Initiative |

A consortium comprising the University of Pennsylvania, Villanova University, Polytechnic University, Community College of Philadelphia (CCP), two Philadelphia public high schools and the Society for Industrial and Applied Mathematics, has undertaken a major initiative to: (1) integrate research and real-world applications into the basic mathematics curriculum; and (2) achieve more effective integration of advanced mathematics and computing into the upper-level curricula of disciplines that use it.

The over-riding goal of this initiative is to promote a climate in which faculty across all disciplines view themselves as being jointly responsible for the education of undergraduates, rather than as clients and servants. The project will accomplish this first within the consortia institutions and then promote the use and development of such materials and methodologies at other institutions using the results as models.

The approaches are based on the experience accumulated at the University of Pennsylvania and elsewhere in developing and promoting large-scale calculus reform. The initiative consists of

four projects: (1) creation of multimedia applications modules for mathematics courses and mathematics modules for other disciplinary courses; (2) development of basic and advanced interdisciplinary courses that integrate mathematics with specific applications areas; (3) development of applications and laboratory-oriented courses for mathematics majors; and (4) development of materials for non-mathematically oriented students in consideration of mathematical literacy issues.

Evaluation of project materials and results is to be carried out at the University of Pennsylvania by a group led by Robert Boruch of the Graduate School of Education, at Villanova by its Human Organization Science Institute, and by CCP's Office of Institutional Research.

Mathematics and Its Applications in Engineering and Science: Building the Links

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The division of courses into many different departments often makes it difficult for students to grasp the intimate connections that exist between mathematics and its applications in engineering and science. Being developed is a library of interactive multimedia hypertext documents that will link important mathematical topics with contemporary interesting applications in various fields of engineering and science. This library will cover the mathematical areas normally studied by undergraduate students in engineering and science, including calculus, differential equations, mechanics and linear systems, advanced mathematical methods, and probability and statistics.

The library is the basis for a constantly expanding resource that supports a growing movement, at Rensselaer and elsewhere, to move away from a lecture-dominated mode of instruction to what is called, a "workshop" or "studio" mode. A traditional course often has several elements (lecture, laboratory, recitation) conducted by different individuals at different times and places, and are often only loosely linked together. A studio course seeks to eliminate the distinctions among these elements by combining them into a single whole. Typically a studio course also features exploration, discovery, and cooperative learning. The hypertext library is useful in a variety of contexts: (1) as a part of formal courses, but also for individual study, review, and enrichment; (2) in courses both in mathematics and also in the more applied disciplines of engineering and science; (3) in courses having a traditional configuration, as well as in more innovative workshop or studio courses; and (4) on two- and four-year college or university campuses and also in educational offerings at remote sites.

The development of these materials involves a collaboration among faculty at Rensselaer and initially, the University of Delaware, Siena College, Virginia Polytechnic Institute, Hudson Valley Community College, and the University of Maryland. Testing and evaluation of the modules as they are produced and assessment of their effectiveness in helping students bridge the gap between mathematics and engineering or science are integral parts of the project. The World Wide Web will be the principal means of disseminating the library of modules. This will provide

maximum access to students and faculty throughout the nation. Portions of the materials will be adapted for publication as CDs or in print form.