

Mathematics Education at SUNY Farmingdale

by Arlene Kleinstein and Sheldon Gordon

The Institution

SUNY Farmingdale, located on Long Island, is one of the sixty-four colleges that comprise the State University of New York. The college was chartered in 1912 as a two-year agricultural and technical institution, the New York State School of Agriculture, serving the needs of the then rural local community. In the intervening years farms were replaced by residential and commercial properties that catered to the employees of huge defense contractors such as the Grumann Corporation, Sperry Corporation, and Fairchild Republic. The last two decades have witnessed the closing, consolidation, or relocation of these former giants. In their place, a large number of small to medium sized high-technology firms have opened their doors. As the nature of the Long Island economy has changed, so, too, has the mission and academic program of SUNY Farmingdale. In 1993 the State University of New York re-designated the Farmingdale campus as a specialized college granting both associate and baccalaureate degrees in the applied sciences and technologies relevant to the current regional economy. Among the newly established four-year bachelor of science programs offered are Aviation Administration, Construction and Facility Management, Manufacturing Technology, Security Systems Technology, and Visual Communications. The college continues to offer a host of parallel associate degree and certificate programs in the health sciences, engineering technology, computer information services, and business.

The Student Body

The student body at SUNY Farmingdale is as diverse as its academic offerings. Approximately 6000 students, both residential and commuters, are engaged in full and part-time

study. These include traditional students entering directly from high school, as well as an increasing number of adult students returning to school for re-training or job advancement. A significant number of our students have relatively weak academic backgrounds, especially in science and mathematics, and many require instruction at the foundation level.

Curriculum Restructuring and Reform

The transformation of SUNY Farmingdale from a two-year college to a four-year institution with a high-technology focus occurred concurrently with a number of major initiatives in international mathematics education. The emerging graphing calculator and computer algebra system (CAS) technology, coupled with reforms in curriculum and pedagogy, presented the mathematics department with the challenge of reconsidering and reformulating our entire program of course offerings. This process was initially accompanied by a painful faculty retrenchment through early retirement incentives that virtually halved the number of full-time mathematics faculty from 21 to 12. However, a positive aspect in this retrenchment may well have been the loss of some senior faculty who would have resisted many elements of change.

The first step in our restructuring was the adoption in 1992 of the Harvard Consortium's recently published Calculus textbook coupled with the required use of hand-held graphing calculators in our university-level calculus courses. The initial reactions to the new syllabus were cautiously optimistic. There were voiced misgivings that some theoretical material was replaced by a looser conceptual approach. But the traditional algebraic emphasis also yielded to a broader view of functions from graphical and numerical perspectives, and a most promising feature of the new syllabus was the seamless incorporation of meaningful applications and real-life contexts in which students encountered the calculus.

The adoption of the Harvard Calculus syllabus served as an anchor for reform efforts in the precursor courses that prepare students for calculus as well as in those courses that follow. The department participated in a consortium to develop alternatives to the traditional remedial algebra courses for under-prepared students. The result of this collaboration has been the publication and adoption of *Mathematics in Action: An Introduction to Algebraic, Numerical and Graphical Problem Solving*. This innovative one-semester course is the “pump” that enables these students to succeed in courses such as introductory statistics and finite mathematics. Precalculus is now taught from a modeling approach using the textbook *Functioning in the Real World*. Our differential equations course incorporates the workbook and CD-ROM set, *Interactive Differential Equations*, that supports study of the qualitative behavior of solutions and their graphical approximations.

Enrichment and Support Services

The department has extended the active-learning and problem-solving experience beyond the classroom to precalculus and calculus students through a voluntary Emerging Scholars Program that follows the model of Uri Treisman’s programs at the University of California at Berkeley and later at University of Texas at Austin. Students meet outside of class once a week to work collaboratively on non-traditional, challenging problems beyond the scope of their classwork. Participation is encouraged by a half-letter grade increase in the course grade for all students who satisfactorily complete the problem sets.

In 1994 the Nancy Thomson Mathematics Center, which provides walk-in tutoring for all Farmingdale mathematics students, opened its doors. The center is staffed by a director (a full-time member of the department), by student tutors, by faculty who volunteer their time, and by several retired members of the local community, including an engineer and actuary, who graciously volunteer their services regularly. In addition to its primary function of providing walk-in tutoring,

the center also offers workshops and review sessions for final exams. The atmosphere of warmth and non-judgmental help encourages students to return and to frequently work on their own. It is not uncommon to see a student who has come for help actually helping another student when the center is busy.

Major in Applied Mathematics

The most significant achievement in our restructuring was the creation in 1994 of the Applied Mathematics Major. This unique program is offered cooperatively by SUNY Farmingdale and the nearby state university center at Stony Brook. Applied Mathematics majors complete their first three years at Farmingdale, which awards an associate degree, and their fourth year is completed at Stony Brook which awards the Bachelor of Science degree. In the first five years of our program we have conferred degrees on 34 students (including 8 minorities and 12 women) who have continued their studies at Stony Brook and other institutions, and have found employment in a variety of fields. We actively recruit our majors from among talented students in our precalculus and calculus for technology courses. We encourage our majors to pursue joint majors in Applied Mathematics and a related field such as computer science, business, or biology. The class size in our required and elective courses for majors is kept small to encourage interaction among students and faculty. We have also obtained funding to hire four of our majors as teaching assistants each semester. The teaching assistants conduct the Emerging Scholar Workshops under the direction of a faculty member, and serve as tutors in the Mathematics Center.

Interdisciplinary Projects

In 1995 the college joined the NSF-funded Long Island Consortium for Interconnected Learning in the Quantitative Disciplines (LICIL), a group of ten public and private local colleges,

under the direction of Alan Tucker of the State University Center at Stony Brook. LICIL provided small summer stipends to faculty to develop innovative curricular activities that promote quantitative literacy and increase connections between mathematics and other quantitative fields. The Farmingdale community enthusiastically responded to this opportunity, and during the four-year LICIL program more than 40 faculty from 10 departments participated in an amazing array of projects. Listed here are just some of the forty activities developed by Farmingdale faculty:

- Collaboration between statistics and manufacturing engineering students to analyze and evaluate machine tool designs.
- Interdisciplinary workshops in mathematics, physics and technology to facilitate the transfer of concepts and skills from the mathematics class to the client discipline classroom.
- A set of quantitative modules for our Urban Sociology course involving the analysis of census data obtained from the World Wide Web.
- An interdisciplinary course in mathematical modeling in the biological sciences.
- A course on mathematical methods in linguistics in which students use basic algebra and statistical methods to investigate the vocabulary within a language and the relationship of languages within the same family.
- A mathematics problem-solving seminar in which our Applied Mathematics majors work cooperatively on non-routine problems taken from the Putnam exams, published books of problems, and other available sources.

LICIL has had a profound and lasting effect on the culture and direction of the college. Many LICIL-funded activities such as the Emerging Scholar Program, laboratory projects and workshops, and interdisciplinary courses have now been institutionalized. The Farmingdale Center for Excellence in Learning and Teaching has recently been created by a group of LICIL participants,

and strongly supported by the administration, to continue the interdisciplinary instructional innovations and collaborations made possible by LICIL.

New Directions

SUNY Farmingdale has devoted considerable efforts in forging connections with business and industry. In 1996 the college established the Institute for Manufacturing Research (IMR) to provide small local businesses with access to modern manufacturing technology and to promote collaborative projects among industry, faculty and students. The college has also formed a partnership with the nearby Cold Spring Harbor Laboratory to build and jointly operate a 125,000 square foot bio-technology research facility on the Farmingdale campus. The goal of this project is to attract start-up companies spun out of Cold Spring Harbor research projects. Farmingdale will create academic programs and curricula tailor-made to the needs of these new firms, and the companies will provide opportunities for student internships, senior projects and faculty consultation.

The Mathematics department has recently obtained some seed funding from LICIL, additional NSF grants, and the New York state legislature to establish the Center for Applied Mathematics. The Center has invited corporations and government agencies to submit research projects that will be investigated by groups of students under faculty supervision. Current projects include a study of heat transfer, and an overview of traffic flow on the major roadways near the campus. We anticipate that some of these projects will produce spin-off modules or projects that are appropriate for introductory courses. In this way we can continue to provide all our students with an appreciation of how their classroom work is relevant to the real world.