Session 2: teaching and delivery of the curriculum
Thursday morning, 2003 June 12

The presentation by Whitla addressed advances in secondary school curricula that will affect the preparation of new engineering students, advances in mind/brain research and implications for styles of teaching, and measurements of the effectiveness of curricula. The presentation by Fogler described alternative delivery methods for a single course. The presentation by DiBiasio described a new arrangement of the sophomore year curriculum.

Titles and abstracts are listed here; the presentations are contained in separate files.

Foundations for Developing Curricular Structures

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Asynchronous Learning of Chemical Reaction Engineering

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Chemical reaction engineering was taught asynchronously using e-mail, the web, texts, and CD-ROMs. The wide variety of resources given to the students allowed for most of the learning styles described by Felder and Soloman. After reviewing the course structure and outcomes from summer 2000, the chemical engineering department's curriculum committee voted to accept the asynchronous learning version of the chemical reaction engineering course as equivalent to the synchronous version of the course offered during the academic year.

A Comprehensive Curriculum Revision of the Sophomore Year

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We know that engineering education in the United States today faces many new challenges. Since the traditional approach to chemical engineering education was designed for a somewhat different set of challenges, we questioned whether it is well suited to meet today's needs. Our main concern was that the compartmentalized sequence of introductory chemical engineering courses resulted in inadequate synthesis of basic concepts, poor retention of fundamental material between learning and application, and low motivation for learning the fundamentals.

The purpose of this project was to create a new curriculum for the introductory courses that would address these problems.

We developed, implemented, and evaluated a project-based, spiral curriculum for the sophomore year of chemical engineering (four courses total). The new curriculum is project-based because students learn and apply chemical engineering principles by actively completing a series of projects, including open-ended design projects and laboratory experiments, throughout their first year of chemical engineering study. It is spiral because the understanding of basic concepts and their interrelations are reinforced by revisiting them in different contexts with increasing sophistication each time.

The project was conducted with funding from the Fund for Improvement of Post-Secondary Education (FIPSE) in the Department of Education. There was one year of curriculum design, two years of experimental implementation followed by an additional year of assessment. The curriculum was officially adopted by the university and two additional years of full scale implementation have occurred.

Our assessment plan used multiple measurements, formats, and time points so that all aspects of the project might be evaluated. For each experimental offering, a separate section of the four sophomore year courses was taught using the new curriculum ("spiral taught" section) simultaneously with a “control” section that was taught in the traditional fashion. Student learning, problem solving abilities, attitudes, retention, and performance in upper level courses were compared between the sections. In all cases, the results were positive regarding the success of the project. Assessment design allowed us to probe program effects from a variety of views. The converging results demonstrated the broad range of educational benefits with the new curriculum.