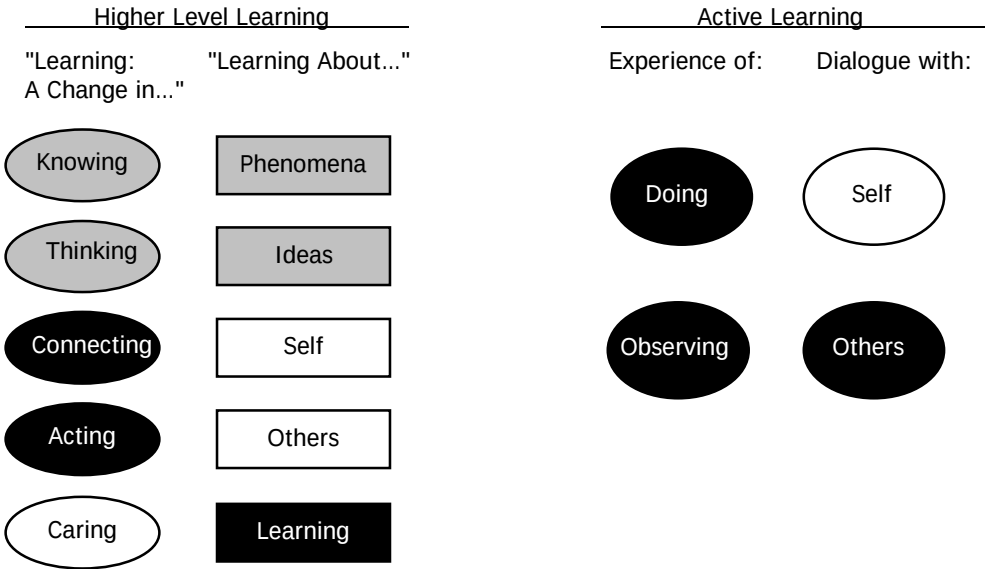

Math, Physics, and Engineering: A multidisciplinary approach to engineering and lifelong learning

The two-semester, experimental freshman pre-engineering curriculum called "Integrated Mathematics, Physics, Engineering, and Chemistry Curriculum" at North Carolina State University (1999)

Course Design:

In each semester of their freshman year, students take one calculus course, one introductory science course, and one engineering course. The first semester science course is chemistry, and the second semester one is physics. As a whole, the curriculum is designed to present fundamental scientific and mathematical materials as they relate to the discipline of engineering. Despite the multidisciplinary nature of the course content, individual class periods are usually taught by a single professor. Several times each semester, however, class periods are replaced by workshops which focus on specific topics, such as statistical analysis or angular motion; these workshops are team-taught by all the members of the program's faculty. Class schedule is designed to be flexible on a week-to-week basis so as to accommodate the changing emphasis of different topics and different related disciplines.

The first semester engineering course replaces the traditional freshman engineering orientation course. It serves not only to introduce the students to the different engineering departments at the university but also to help improve students' understanding of mathematical computer applications, their execution of technical writing, their delivery of oral presentations, and their use of time management, teamwork, and study skills. The second engineering course is based on the use of the automobile as the link between calculus and physics. At the end of both the first and the second semester engineering courses, students complete a team project. In the first project they design a propane-fired water heater and shower for a recreational vehicle; in the second they build a model of an automobile steering and suspension system. In both cases, students present written and oral reports which detail how they integrated the relevant calculus, chemistry, and physics principles into their design.

Higher Level Learning:

By learning calculus, chemistry, and physics in the context of reality-based engineering problems, students begin to integrate the spheres of knowledge that are necessary to understanding the principles of engineering (**Connecting**). Integrating the lecture and laboratory components of the courses is made possible by multimedia instructional packages, which supplement the texts, and by the use of both computer simulations and physical experiments (**Acting**). The multidisciplinary and problem-solving emphases of IMPEC, as well as the focus on fundamental communication and study skills, encourage students to change their approach to both project design (**Acting**) and to studying Engineering (**Learning**).

Active Learning:

IMPEC stresses the application of calculus, chemistry, and physics to carrying out engineering design projects (**Doing**). Numerous group projects as well as occasional field trips enable students to learn the necessary skills not only through the instructors' modeling but also through working alongside their peers (**Observing**). From the beginning of the orientation conducted by the different engineering department heads until the end of the automobile steering and suspension project, students are involved in a constant dialogue about the knowledge and skills that must be applied in their chosen discipline (**Dialogue with Others**).

Felder, R. (1999). IMPEC. [On-line]. Available: http://www2.ncsu.edu/unity/lockers/users/f/felder/public/Impec/html (04/01/99)