



***Chemistry: Innovation, cooperation, and learning through individual projects***

A course in general chemistry by Dr. Dudley Herschbach, Harvard University (1996)

**Course Design:**

Dr. Herschbach's course usually numbers close to three hundred and fifty students, most of whom are freshman who have taken a high school chemistry class. Such classes typically place greater emphasis on solving numerical problems than on developing the mental disciplines necessary of all liberal arts, namely self-generated questioning and thinking.

Introductory science courses are generally accompanied by high levels of student anxiety which lead to students approaching numerical problems and laboratory work in a slavish rather than experimental spirit. In order to minimize this counter-productive attitude, Dr. Herschbach only assigns an exercise in preparation for student-selected, student-designed, projects. In the first seven weeks of the course, students work on a training project designed to familiarize them with the basic techniques in different areas of chemistry. During the last four weeks of the term, students work on a personalized variation of one of the six to eight projects described in their laboratory manual. Students submit a report in the form of a research article, which is reviewed by the teaching fellows and returned if necessary for corrections. The best reports are frequently published in the University's *Journal of Undergraduate Sciences*.

The course's exam and grade policy are also designed to encourage innovation, cooperation, and learning. All work is graded on an absolute grading scale, rather than on a curve. Student collaboration is promoted over student competition. In addition, the questions that each student misses on hourly exams are added to his or her final exam in an effort to foster a comprehensive understanding of the material.

**Higher Level Learning:**

The course is designed not only to promote a better understanding of chemical principles and laboratory techniques (**Acting**), but also to foster the critical thinking skills necessary for the study of all liberal arts (**Thinking**). Students discover how knowledge is pursued in chemistry and re-evaluate how they perceive this learning process (**Learning**).

**Active Learning:**

The course emphasizes that the frontier of science is not a frozen body of dogma, but rather an area of dynamic and personal innovation. Students are encouraged to devise their own approach to laboratory projects (**Doing**) and to collaborate with each other and the teaching fellows (**Dialogue with Others**). The interchange of ideas in the course serves to model the interactions that are called for in the field (**Dialogue with Others, Observing**).

Herschback, D. (1996). Teaching Chemistry as a Liberal Art. Liberal Education, 82 (pp.10-17) Washington, D.C: Association of American Colleges and Universities.