Unifying Science Concepts:
The George Engelmann Mathematics and Science Institute - Summer Science Scholar Program

Today, scientists are probing the stars and cataloging the human genome—explaining the universe and life in ways that previous generations never imagined. Improvements in health care extend life far beyond what was expected a generation ago. From microprocessors to artificial intelligence, technologies growing out of science affect our daily existence in micro-subtle ways as well as in a gross global manner. As we enter a new century, these technologies and their effects will continue to increase at an exponential rate.

As we rapidly approach the 21st century, there is one concern upon which social, economic, and political questions rest: Will there be an adequate supply of trained leaders to answer the new, highly technological challenges facing us? Recent trends have raised doubts about the adequacy of our preparation of future citizens in the fields of science and mathematics. These trends, combined with the past decade's sustained growth in employment opportunities, have led some experts to predict shortages in the sciences and engineering workforce for the future.

Curiosity, in the broad sense of intellect, and competition are two natural components of the human being, and are driving forces for success in every environment including the high-tech society of today. These human behaviors can be altered through the societal mechanism for reward and reinforcement...simply, no reward no achievement. Society can easily direct its focus and the fields of achievement by issuing rewards and encouragement in directions of its choice.

To encourage students to be successful in careers in science, mathematics, and their related areas, we must adjust our reward system so that students will flow into these areas. The cost/benefit ratios must be of such proportions that students will naturally move into technical fields. The reward framework can include both intrinsic and extrinsic mechanisms.

In response to this problem the University of Missouri-St. Louis established the George Engelmann Mathematics & Science Institute in 1988. This intensive, four-week summer experience provides talented high school juniors and seniors with a creative, interdisciplinary approach to learning advanced concepts in science. In each of the past four summers, fifty St. Louis-area high school students have participated in the Engelmann Institute. The Institute is a highly successful program that provides the structure for developing intrinsic values for curiosity and academic achievement.

A focal point of the Engelmann Institute is the Science Seminar Series. This group of lectures addresses related subject matter in the interdependent disciplines of biology, chemistry, physics, and mathematics. The program introduces Engelmann participants to a basic set of concepts and then helps them apply that information to relevant, current problems illustrating paradigms presented in Philosophy of Science. Like a mental microscope, the program focuses on such specifics as the AIDS virus, genetic engineering, and the problems of world overpopulation. Unlike the mechanical approach associated with operating a microscope, these topics are approached from the perspective of the philosophy of science and the pragmatic definitions of truth.

Participants take field trips to research-based corporations and institutions to observe the applied component of the Science Seminar Series and to help reinforce career opportunities. These young people not only exercise their minds for four weeks in the middle of the summer, they also exercise their bodies on the softball field and the volleyball
court, where they are introduced to the physiology and physics of the sports. The concluding days of the program are filled with finalizing research papers and making oral presentations.

The George Engelmann Mathematics and Science Institute is a successful program that provides talented high school students with a creative, interdisciplinary approach to learning advanced concepts in mathematics and science.

Additonal information regarding The George Engleman Mathematics & Science Institute and Summer Science Scholar Program can be obtained by contacting:

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RESEARCH AND SCHOLARLY WORK IN CHEMICAL EDUCATION
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The following list suggests activities that might be used in making tenure and promotion decisions for faculty members whose emphasis is in the area of chemical education. In addition to excellence in teaching, research, and service (the traditional criteria for granting tenure or promotion), activities such as these should also qualify as scholarly work in chemical education.

1. Development of New Courses and/or Curricula, such as:
   - Chemistry Courses for Science or Non-Science Majors
   - Science Education courses for Teachers
   - Laboratory Courses
   - Special Topics Courses

2. Leadership at Professional Meetings
   (Local, Regional, National, or International)
   - Invited Lecturer
   - Presenter of Papers or Posters
   - Organizer of Symposium or Workshop
   - Chairman of Professional Organization or Committee

3. Published Articles in Journals such as the following:
   - Journal of Chemical Education
   - Journal of College Science Teaching
   - Science Education
   - School Science and Mathematics
   - Journal of Research in Science Teaching

4. Submission and Funding of Grant Proposals for projects such as:
   - Chemical Education Research
   - Laboratory Instrumentation
   - Teacher Pre-Service or In-Service Programs
   - Science Programs for Primary or Secondary Students
   - Production of Chemistry Teaching Materials

5. Contributions Toward Instructional Improvement, such as:
   - Introducing New Chemical Demonstrations
   - Developing New Laboratory Experiments
   - Providing Guidance for Teaching Assistants
   - Creating Models or Other Visual Aids for the Classroom
   - Finding New Uses for Computers in Chemistry Teaching
   - Developing Audio-Visual Materials or Computer Software

6. Other Activities in Chemical Education:
   - Authoring a Textbook or Support Materials
   - Review of Textbook or Journal Manuscripts
   - Review of Chemistry Programs or Grant Proposals
   - Interpretation of Chemistry for the Public
   - Involvement in Writing of National Chemistry Exams
   - Participation in Chemical Meetings or Workshops
   - Service on Chemical Education Committees or Task Forces