

**INTRODUCING K-12 STUDENTS TO CHEMICAL ENGINEERING AND  
CHEMISTRY THROUGH LABORATORY EXPERIMENTAL  
MEASUREMENTS**

**BY**

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**ABSTRACT**

The New Jersey Institute of Technology Sponsors a range of outreach programs geared toward K-12 students in order to expose and interest them in science and engineering as a career. These programs have a chemical and chemistry component which is a lecture/laboratory format that is directed to experiential learning and communication skills.

**INTRODUCTION**

The Pre-College Center of New Jersey Institute of Technology has a broad range of outreach programs aimed at introducing K-12 students to science and engineering as a career choice. The various programs which have a chemical engineering and chemistry component are:

- (1) Chemical Industry for Minorities in Engineering (ChIME)  
(7th and 8th Grades)
- (2) Upward Bound (10th to 12th grades)
- (3) Females in Engineering: Methods, Motivation and Experience  
(FEMME)
  - (a) FEMME Continuum (6th & 7th grades)
  - (b) Senior FEMME (8th & 9th grades)

### ChIME

This program is designed to give seventh (7th) and eighth (8th) grade urban youngsters an opportunity to increase their awareness, understanding and participation in science and engineering.

The chemical engineering and chemistry portion of the ChIME Program introduces the students to careers in chemical and environmental engineering through the use of video tapes, lectures on the theory and operation of apparatus for measuring pressure drop in packed towers, circular conduits and fluidized beds, calibration of flow meters, draining time of a circular tank, neutralization of stomach acid by "tums", and temperature measurement by different type thermometers.

This is followed by the students operating the pilot plant sized equipment, recording the data obtained and then data analysis. Students then with assistance from the course instructors are taught how to prepare a brief technical report and audio visual materials for an oral presentation both of which are the culmination of the course. This portion of the overall twenty (20) day program is done in five (5) days.

The program is funded from donations by Colgate-Palmolive Co., Amerada Hess Corp., Exxon Chemical Co., Merck Institute for Science Ed., Mobil Foundation Inc., R.W. Johnson Pharm. Research Inc., and Rohm and Haas Co., ChIME Inc., Union Carbide and AIChE

### FEMME

FEMME is a three level program which consists of Introduction to FEMME (4th & 5th Grades), FEMME Continuum (6th & 7th Grades), and Senior FEMME (8th & 9th Grades). The FEMME program is designed to enhance the students math and science skills, improve their self confidence and encourage them to choose careers in technological fields. Industrial sponsors of the program are National Starch & Chemical Corp., Bell Atlantic, Geraldine R. Dodge Foundation, The Leaven Foundation, R.W. Johnson Pharm. Research Ins., and PSE&G Co..

FEMME continuum students only undertake experiments on neutralization of acids by titration and temperature measurement by mercury in glass and metallic dial thermometers. This program, which is a two (2) day effort, only involves data taking, analysis and graphical representation.

Senior FEMME participants undertake experiments in the senior chemical engineering laboratory which encompass experiments on pressure drop in packed towers, circular conduits and fluidized beds, calibration of rotameters and time for draining of a cylindrical tank. Students in this program undertake two (2) (calibration of a rotameter and one other) of the listed experiments, take data, analyze it, write a report and make an oral presentation on one of the experiments they have studied. This program lasts for four(4) days.

#### UPWARD BOUND

The Upward Bound math and science center program is funded by the US Department of Education and is designed to enhance high school student's academic ability and interest in mathematics and science.

The program is an intensive six (6) week summer program which meets for five (5) days a week. As in the other programs, chemical engineering is only a part of the program and is a lecture/laboratory integrated experience consisting of 3.5 hours per section, (25 students) one day per week. The lecture topics cover the theory of experimentation, statistics, unit dimensions, graphics, data collection and analysis, oral presentation and report writing. The course also has a homework assignment component. The laboratory experience consisted of experiments on the chemical pilot plant size equipment listed previously. Students undertake experimentation, in groups of three in greater depth than any of the other programs and are expected to undertake more than one experiment. After the data reduction and analysis, a detailed technical report is prepared. Based on their laboratory experience and their written report, an oral presentation is made to their class and the program faculty.

The students review of the chemical engineering portion of the programs was unanimously excellent. They were particularly excited with the "hands on" laboratory experiments but also found the communication efforts rewarding.

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