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Climbing bloom's ladder

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ACS Presidential Election

Climbing Bloom's Ladder

by Isiah M. Warner

Current demographics do not provide an optimistic outlook for producing future scientists in this country. However, the ACS can contribute to a more favorable picture.

In my thirty-plus years in academics, I have found many students who, by natural ability, interest, and work ethic, should have performed well in the sciences, but performed poorly. In recent years, I have come to better understand this problem: many of these students are operating at the bottom rungs of Bloom's taxonomy (ladder) *(1),* while we as college professors and industrial employers need these students to operate at the upper rungs of this ladder. Unfortunately, many students graduate from high school, and even college, without realizing that levels of thinking above memorization and basic comprehension exist.

Education of Scientists/Chemists

Experience tells us that the education of our next generation of scientists/chemists must start at the elementary school level. Unfortunately, a common approach to science in early education includes activities that depict science as a magic show rather than a method of reasoning. Far from encouraging children to pursue education in the sciences, this approach perpetuates the myth that science can only be done by an Einstein or a magician.

Many students do not acquire the basic tools to survive our science education system because they cannot make the leap from rote memorization, which they used in K–12, to the advanced scientific reasoning that is required for conceptual understanding. These students represent a potential science resource since it is possible to make this leap.

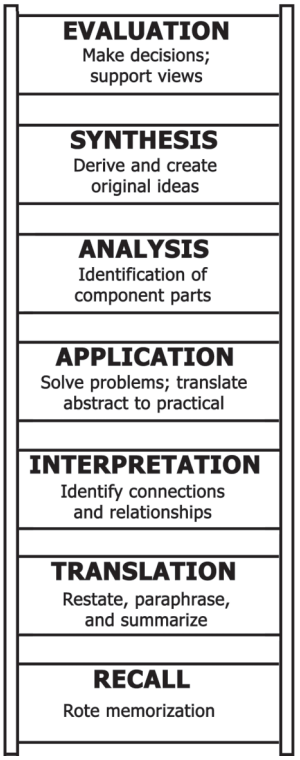

Figure 1. Bloom's Ladder.

Education of future scientists/chemists is enhanced by early development of students' critical thinking skills through use of supportive exercises. Students must also take science and mathematics courses that require proficiencies in learning strategies, study skills, and time management. Discovery-based learning needs to be introduced early in the educational process, with a strong focus on the transition points where many students turn away from science careers. Many K–12 schools do not address these problems, often not because they don't understand or want to address the problem, but rather because they lack resources or personnel.

photo: Jim Zietz, LSU Univ. Relations

Isiah M. Warner

What Can the ACS Do?

Clearly, there are no simple solutions to the problems associated with producing our next generation of scientists since our future workforce must be diverse, well-prepared, internationally competitive, and globally aware. These new scientists will enter the field through multiple educational pathways and they must be prepared for the challenges ahead.

The search for solutions to science education problems must begin at the grass-roots level. If I am elected 2005 President-Elect of the American Chemical Society, I will help organize and lead such an effort. One approach involves using our dedicated and talented legion of retired chemists to transform the teaching of science. By developing a series of workshops on mentoring, learning strategies, time management, and scientific reasoning, we could enable this large pool of legionnaires to facilitate student learning in science at the K–12 level. With the support of electronic media produced by ACS, we could organize workshops through local sections that dramatically impact students and teachers, as well as enrich the learning environment. These workshops could provide a platform from which our local ACS members could empower the overall ACS organization to contribute to the education of our future science workforce in substantive ways.

We must focus special efforts on undergraduate students who have made it through the K–12 system without the learning tools and strategies needed for a successful undergraduate career in science. In the past, we assumed that it was nearly impossible for such students to become great science majors, but recent educational studies suggest otherwise. Although these students are not always easy to reach, they represent a largely untapped pool of potential future scientists.

I do not claim to have all of the answers to our science education problems, but I do know that moving students to the top rungs of Bloom's ladder will help in this effort. Indeed, it is possible to climb Bloom's ladder at various stages of the educational enterprise and to develop the skills necessary to become a successful scientist.

Literature Cited

1. *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain;* Bloom, B. S., Ed.; David McKay: New York, 1956.

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