

## FACILITATING LEARNING:

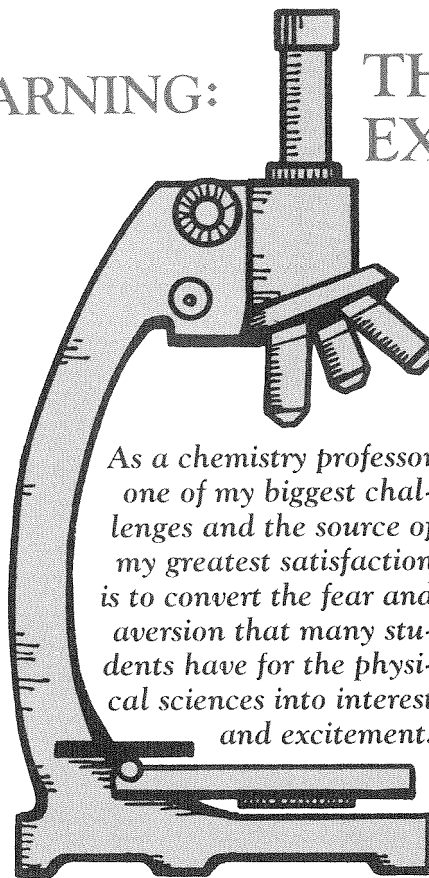
## THE LABORATORY EXPERIENCE

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**A**t the American Association of Higher Education conference in March, 1988, Dr. Stephen Brookfield addressed a group of educators on the topic of facilitating adult learning. The results of his research, however, can be extended to learners of all ages. He listed four factors that enhanced the learning experience: (1) the learning had some connectedness to real life; (2) the learning was unanticipated and unexpected; (3) the learning involved challenge, self-scrutiny and anxiety which led to enhanced self-esteem upon coping; and (4) learning occurred in an informal community support group. While any learning experience involves one or more of these factors, the laboratory component of the sciences is particularly suited for targeting all these aspects of the learning experience.

As a chemistry professor one of my biggest challenges and the source of my greatest satisfaction is to convert the fear and aversion that many students have for the physical sciences into interest and excitement. One of the biggest helps in this regard is the development of rapport among the students themselves. Generating a feeling that the student is not alone is a major advantage in encouraging and sustaining him/her. The students seem to form these support groups most easily through the laboratory experience.

In the lab the student is faced with a problem or a question to investigate. The setting is organized, yet informal. The student may move about, talk to other students, faculty, and assistants. The lab period is a minimum of three hours to a maximum of six hours depending on the particular course. In the beginning courses the procedure for investigating the problem is provided for the student. In the advanced courses the student designs his/her own procedure based on methods in the literature.



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This experience addresses all four of the factors in Dr. Brookfield's research. Often the beginning student is investigating some phenomenon obviously related to real-life experience (though it may take some reflection to appreciate all aspects of the data): for example, the effect of pressure on the temperature of boiling water, comparison of the power of various commercial antacids, the difference between weight and density, and even how organisms produce alcohol and how we isolate it. In later courses, chemistry students examine more sophisticated and subtle principles underlying physical phenomena; for example, how the size of a polymer can be determined from its viscosity, how enzymes work to enhance the rate of a chemical reaction, how one goes about synthesizing a new compound.

Often the discoveries made are unanticipated and unexpected. Students do not expect colorless solutions of salts to produce beautiful vivid colors when burned in a flame, for example. Nor do they expect simple techniques to result in the separation and visualization of the different components of common headache remedies. Even errors made in lab can often lead to the illustration of some other principle

than the one being investigated.

The sciences for many students are particularly challenging and anxiety-producing, perhaps because they represent a mode of thinking with which the student is unfamiliar. As the student tackles the course material and applies this knowledge in the laboratory, he/she experiences the satisfaction of successfully completing an "impossible" task. A field of endeavor that the student may have thought was closed to him/her has been opened. This positive feeling encourages the student to expand his/her studies and may spill over into other areas as well.

All of the above experiences often occur in the body of the support group — the other students in the lab. The students study together, analyze data together, and celebrate together once the course is over. This support continues from the beginning courses on through the advanced courses for those students who major or minor in a science. In addition, interested students may often assist in labs, making solutions and answering other students' questions. This type of work requires students to review prior coursework and to master the material well enough to explain it to someone else. Teaching assistants advance through the ranks from green badge for the novice, red badge for the intermediate, and blue badge for the senior assistant. This progression further enhances the students' self-esteem, the feeling of belonging to the group and to the profession.

The advantages to the lab experience can be adapted to classes in other disciplines. Many of us have made the same observations as Dr. Brookfield without perhaps compiling them and incorporating them into our courses. The key ingredients are a challenging problem with some relation to real life, an informal support group, and a "surprise ending." Getting the students involved in their own learning is essential for success; the lab experience virtually forces the student to be involved. The challenge for us as teachers is to incorporate more of this atmosphere into the traditional classroom setting. ●