ABT
11250 Roger Bacon Drive #19
Reston, Virginia 22090

Letters to the Editor

Dear Editor:

There are pleasurable and gratifying moments in learning, but for the most part, learning is hard work. Upon graduation from high school and college, society expects the student to be literate in about every aspect of living. Research tends to indicate that too many of our children cannot read or spell, and, that they are illiterate in the sciences and mathematics. Schools are admonished from many quarters to ". . .abandon much of their traditional, memorization-based instruction in science and math" and according to the American Association for the Advancement of Science, ". . .shift their emphasis to helping students think about how things and organisms work and how they relate to one another." "Memorization out, 'Broad Understanding' in. . .", proclaims a newspaper headline. "Wider use of calculators would reduce the need for drills and make more time available for higher mathematics and problem-solving exercises with real-life examples," states the National Council for Teachers of Mathematics.

The message seems to be clear: Avoid rote learning! But, are we being too critical of the place of memorization in learning? Much is said about learning through inquiry and rightly so. Enough research data are available to indicate that we tend to learn and retain knowledge more effectively if we are allowed to derive information through active participation in the learning exercise. Learning is not an either-or proposition between rote and inquiry or deductive and inductive learning; rather, it is the judicious use of each on the part of the teacher. To read well, one must read, read, read. In order to reason inductively, the student must acquire certain basic knowledge (memorize crucial factual information) with which to carry out the much desired inquiry approach to problem solving. There is no substitute for memorizing and practicing fundamentals. Hence, we practice medicine, we practice law; as well, we must practice constantly to be better teachers.

In the 1920s, education introduced the Morrison Plan and the Winnetka Plan, both designed to individualize instruction. Learning machines took the student, via a table-top mechanical device, down a linear or branched avenue to learning. Today we have television, VCR's, computers and the photocopying machine. There is no magic in a device or a method. These innovations enhance education and enable the teacher and the student to have access to learning resources unimagined in the early part of the 20th century. But, as useful and as necessary as the innovations are, learning is not easier. The innovations are only so good as the teacher chooses to make them.

What then is critical to learning? . . .at least, a genuine desire to learn on the part of the student; parents who will unselfishly work to help their student learn; and the necessary self-discipline and aligning of priorities on the part of both the student and the parents. Then too, the teacher and the school must assure the learner that the fundamentals of any discipline or activity will be presented effectively, in the best possible learning environment.

Laddie J. Bicak
Professor Emeritus
Department of Biology
Kearney State College
Kearney, NE 68849

Dear Editor:

Most or all of the reasons given for poor science education in the United States in the editorial "What's Wrong with Science Education & How Do We Fix It?" (September 1990) were, in my opinion, relevant, correct and important. However, there is an additional reason why not only science education but education in general in the United States is relatively poor and ineffective: A large portion of the educational system is built on the incorrect belief that learning is, or should be made to be, fun. Learning, as distinct from knowing and being able to do, is not fun for most persons; it is simply hard work.

The sooner our educational system rids itself of this false notion and builds its philosophy and practice on a more correct basis, the sooner will the quality of teaching and learning, in science and elsewhere, improve.

Werner G. Heim
The Colorado College
Colorado Springs, CO 80903

Dear Editor:

I would like to supplement my earlier article on the care of parasitic lampreys in captivity (*ABT, 51*(2):115–119, 1989), based on my experience with silver lampreys (*Ichthyomyzon unicuspis*) in the summer of 1989:

(1) In my original article, I stressed the importance of providing tanks with secure covers to prevent hosts from jumping out. In 1989, I initially covered each tank with a wire mesh screen weighted with a 7.7 kg brick. Nevetheless, a 1.6 kg carp (*Cyprinus carpio*) was able to dislodge the cover of its tank and jump to its death, carrying five lampreys with it. At the suggestion of my colleague James Hodgson, I secured all covers with elastic cords of the type known as "tie-downs" or "bungie cords." Not only did these prevent further mishaps, but they were easily adjusted and permitted ready access to the tanks.

(2) In my original article, I recommended carp as a readily available host species, but carp did not prove to be suitable hosts for silver lampreys in 1989. Lampreys of various sizes attached to carp for days at a stretch but were apparently unable to penetrate their thick scales. None ever produced a puncture wound of the sort typically associated with blood-feeding lampreys, and both growth and survival were poor. However, puncture wounds were made by silver lampreys attached to channel catfish (*Ictalurus punctatus*), which have naked skin with no scales; Roy (1973) (see my original article for a complete citation) also found silver lampreys capable of forming puncture wounds on channel catfish. I therefore suggest channel catfish as an alternative to carp, with the caveat that catfish may on occasion prey on small lampreys. Trout and other fish with small scales would probably also be suitable hosts for silver lampreys.

Philip A. Cochran
Division of Natural Sciences
St. Norbert College
De Pere, WI 54115

Dear Editor:

W. Marshall Darley's thoughtful article, "The Essence of Plantness," (September, 1990), considered why plants are considered inferior to animals. Inferiority has advantages. Plant reproductive organs, or flowers, are used as symbols of love, are proudly displayed in homes, and are the subjects of some of the world's most expensive paintings, such as Van Gogh's "Irises" and "Sunflowers." Using animal reproductive parts in such ways would be totally unacceptable.

David R. Hershey
University of Maryland
College Park, MD 20742-5611

Dear Editor:

Those who are concerned about science illiteracy might want to ask the following questions: Is there a chance that the teachers of teachers lack a critical part of scientific literacy? Do the teachers of teachers know in an explicit and detailed way that the central and crucial activity in science is the formulation, the development, and the application of theories, both large and small theories? Do they know that firmly established theories give logical structure to most knowledge in textbooks?

Can the teachers of teachers answer the following questions applied to the courses they teach?

1. What are the embedded and active theories included in this course? Identify all theories even though they are not commonly called theories, even though they lie hidden in the dogmatic language of textbooks. [An embedded theory is a theory, or a theory equivalent, whose central propositions (postulates, fundamental assumptions, basic premises) are so firmly established that they are accepted as general facts or laws.]
2. What are the postulates of each theory?
3. What are some examples of lines of reasoning used for support, explanation and prediction in each theory?
4. What are the range of applicability and the limitations, the boundaries, of each theory?

If one bases answers to these questions on what is found in textbooks, one will conclude that these questions are being answered at about the 2 percent level. The central activity in science is largely ignored.

Ralph W. Lewis
Professor Emeritus
Michigan State University
East Lansing, MI 48824-1031

Dear Editor:

I noted a significant omission in my article "Measuring nitrification: A laboratory approach to nutrient cycling" (October 1990). The wavelength needed for spectrophotometric analysis of nitrate was omitted. The correct wavelength is 470 nm.

David J. Hicks
Biology
Manchester College
N. Manchester, IN 46962