Are Students Learning from Their Teachers or the Media?

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NEIL Shanker (1995) reported recently on a technique of giving a general interest questionnaire the first week of class to generate interest in biology. This is a fun technique, but I was most interested in the number of wrong answers given by students to fairly ordinary biology questions. Most students (68%) thought that sugar, not bacteria, causes tooth decay, and that rust (81%), not a bacteria, causes tetanus. I thought, "Well, even though we are in the same state, my students are smarter than that!" Of course, I realized that, according to Krupka, Vener and Engelmann (1996), students' knowledge of alcohol and tobacco is still quite poor (average scores of 70.4% on alcohol and 59.3% on tobacco, based on 27 questions on each; hence C- and F grades, respectively). At least some students at Arizona State University think that Alzheimer's is an imported beer, that Yasser Arafat is an Israeli leader, that Fidel Castro is a Palestinian leader whose wife buys a lot of shoes, and that OSHA is a killer whale at Sea World! (Supplied by Larry Martel as reported in *Newsweek*, August 28, 1995.)

In a recent study, I showed that even female biology majors do not recognize female scientists who should serve as role models (Brattstrom 1995). I was also apprehensive because, on April 11, 1994, I had asked my General Biology class (for nonmajors) where they got their news. Most got their news from five minute bits on music stations. About half the class watched at least an hour of television news at least once a week; fewer had read a news magazine within the week, and 30 out of 107 had only read a news magazine within a year. But I thought I would give it a try, and the results are very interesting; we do teach, but we have a hard time overcoming false information provided by parents and by the media, especially advertising.

Materials & Methods

I gave a true-false test to my nonmajor General Biology class in fall 1995. I gave the test on the first day of class, August 29 (N=163), and I included the same questions as part of the final examination, December 20 (N=147). The 25 questions included 20 questions that were the same as those asked by Schanker (1995), plus five of my own (Table 1). Since they were a part of the first day's lecture, the answers to Questions 1 and 2 were written on the board. I had asked the students to copy down the material on the board before class. Questions 22–24, like Question 2, were of special interest to me as a herpetologist who is always responding to questions about poisonous snakes, snake bites, and toadstools. Two of the pretests were excluded and not listed or tallied since one student wrote "Your Name" in the blank requesting "Your Name" and another put Os and Xs when the directions called for Ts and Fs.

The class was fairly typical for Biology 101 students at California State University, Fullerton for the last few years, with a large number of students not attending class, or attending only occasionally, and a large number of students not really interested in achieving, learning or passing; or if so, with a D grade. Many students seem to be attending college for social reasons or for as long as parents are paying the bills. Many students seem to just want to complete the course, get a degree, and get a good paying job. In my Biology 101 class in spring 1994, 81/107 (76%) of students lived at home with parents or other relatives and did not work, or worked less than 20 hours/week. Fortunately, for the sanity of all us teachers, there are always the students at the top end of the class! In any event, based on a 90%, 80%, 70%, etc. of total points on four, 200-point lecture exams, the grades in the course for fall 1995 were A:5, B:27, C:54, D:50, F:25, U (which turns to an F):9. On the pretest, in response to a question I have asked every semester for years, the students' favorite color was blue (34%), followed by pink/red/purple (20%), and green (19.6%). The class was composed primarily (78%) of freshmen and sophomores, with about 22% junior and senior procrastinators. The majority of students were business, communication and engineering students (39%), with the remainder scattered among other majors.

Results

The results of the pretest and the same questions asked within the final exam are presented in Table 1.

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Table 1. Number of students giving wrong answers to 25 general questions on a pretest given the first day of class and on the final exam. The questions with their number underlined are true, the rest are false. Questions with an * are the same questions asked by Schanker (1995).

Pretest	*Final*	
2	2	1. Biology is the study of living things and includes botany, zoology, and microbiology.
8	13	2. Herpetology is the study of amphibians and reptiles.
83	18	3.* Vitamins provide you with energy.
12	10	4.* The lungs are part of the digestive system.
37	26	5.* Humans and dinosaurs once coexisted.
124	86	6.* According to Darwin, modern giraffes have such long necks because their ancestors were constantly stretching to reach leaves.
115	34	7.* According to Darwin, chimpanzees evolved into humans.
62	4	8.* An oxygen molecule you just inhaled could have been inhaled by a dinosaur long ago.
107	80	9.* Tropical rain forest soil is rich and good for farming.
83	70	10.* Most ocean life is found toward the center of the ocean away from the coasts.
13	10	11.* Aerosol spray bottles in the U.S. contribute to ozone layer depletion.
144	18	12.* World-wide birthrates have greatly increased in recent years.
37	10	13.* World population numbers have increased so that there are nearly 6 billion people on the earth.
86	66	14.* Science can solve most of society's problems.
79	22	15.* Some photosynthetic reactions can occur in the dark.
78	21	16.* Cold outdoor temperatures can cause the common cold.
138	60	17.* If you step on a rusty nail, the rust can cause tetanus.
76	46	18.* In the U.S. tuberculosis is a rare disease today.
24	14	19.* Warts can be caused by touching toads.
46	4	20.* A fever can help the human body fight disease organisms.
153	51	21.* Sugar causes tooth decay (dental cavities).
108	64	22. More people die of snake bites in the U.S. each year than of black-widow spider bites.
128	47	23. Bee, ant, and wasp stings kill about as many people in the U.S./year as guns.
75	26	24. The homicide rate in the U.S. is increasing and the suicide rate is declining.
69	8	25.* In the U.S., AIDS is the most common sexually transmitted disease.

Most students had appallingly poor scores on the pretest; the data were similar or worse than that provided by Schanker (1995). He reported that 88% of his students thought that sugar caused tooth decay; 94% of my students thought so. Some 81% of his students and 84% of my students thought that rust, not bacteria, caused tetanus. Fortunately, my students improved and the number of wrong answers at the end of the semester was down (still, a poor showing of 35% wrong for the sugar question and 41% for the tetanus question).

Some of the questions provide interesting perspectives. While almost all students had Questions 1 and 2 correct (the answers were in front of them on the board as part of the day's lecture), apparently a few can't read! While most people had learned, prior to this class, that the lungs were not part of the digestive system (Q 4), some believed, and still believed at the end of the semester, that humans and dinosaurs coexisted! Most people thought that vitamins provided energy, but this changed after explaining the role of vitamins as coenzyme or electron carriers. Most people came into class with an erroneous view of evolution and the role of natural selection as eliminating the unfit. The phrase "Survival of the Fittest" is such a catchy one that students erroneously think that this is how most of evolution works. While many seemed to learn a bit about evolution from class (Q 6,7), their view of the mechanism is still Lamarckian (Q 6). That matter, including individual oxygen molecules, cannot be created or destroyed, was learned (Q 8), but most, in spite of conservation programs, still think that tropical rain forest soil is rich and good for farming (Q 9). Most people knew, prior to class, that toads do not cause warts (Q 19), yet some still thought so at the end of the class. As a herpetologist and in spite of lectures, overheads, and professorial antics with toy animals, I am sad to see that people still think that snakes are so dangerous (Q 22). On the other hand, it is good to see that students slowly are beginning to recognize the fact that, in spite of the news reports, homicide rates in the U.S. are actually declining, that suicide rates are rising, and that, while AIDS is an important concern, the treatable STDs (chlamydia, syphilis and gonorrhea) are much more common than AIDS. Rewardingly, the correctness of responses increased as the semester progressed. Seven of the questions were given as part of regular lecture exam II (covering mitosis, meiosis, genetics, Monera and Protista). Decline in wrong answers for pretest, exam II, and the final exam show the following numbers in order:

Question 16 (78-24-21), Q17 (138-112-60), Q18 (76-36-46), Q19 (24-21-14), Q20 (46-6-4), Q21 (153-59-51), Q25 (69-8-8). The most important finding from these data is that, overall, most students learned, at least as far as responding to questions on the test. Yet, a

significant number of students retained old ideas or information. It is difficult to know how much of this is due to the media, early unlearned facts (dinosaurs and humans coexisting, as in the Flintstone cartoon series), and how much is due to the fact that these students did not come to class or just didn't care. To try to find the answers to these questions, I looked to see which questions were missed by 5 A students, 26 B students, 16 D students, and 11 F students. All questions were missed by some students in each grade level except for the A students, but even then, at least one of them missed Question 5, 9, 10, 11, 12, 14, 15, 21, 22, 23 or 24. D and F students still missed Question 6, 7, 9, 10, 17, 21 and 22 in sizable numbers. I then tracked the number of errors made on both tests by individual A, B, D and F students (N = the same as above) to see what the improvement was. The difference, in number of questions missed, between the two tests, i.e. the improvement, was lowest for F (3.8) and D (4.5) students and higher for B (6.1) and A (6.8) students. So, while all students learned, A and B students learned more. A and B students had fewer original wrong scores; they also brought a body of correct and incorrect knowledge with them to this course.

Discussion

It is clear from this and other studies that even the pick of the crop, i.e. the students who get into college, come to us with a body of misinformation. It appears that much of this comes from misinformation in advertising or stories and myths perpetuated by parents. Many students come to college with a correct body of general information about biology, thanks to previous teachers. Newspapers, magazines and television don't appear to have had as much an influence as we would like to think. Maybe students watch mostly MTV rather than PBS! The media appear to have provided some teaching, but perpetuate some myths (homicide rates, snake bite risk). My data from a similar Biology 101 class in spring 1994 indicates that 35% watched a full hour of television news once a month or less; 57% had read a news magazine like *Time* or *Newsweek* less than once a month, once a year, or never. While many students (38%) read (within the week) a nonschool related book, 56% had read an outside book only rarely (within the month or year). Maybe many of these students are not interested in school, or not interested in learning the answers to these questions. If so, it is sad both for their own health and the health of their children (e.g. tooth decay, tetanus, STDs). Remember that 50 students in the 1995 class received a grade of D and 34 received an F or U. Perhaps the latter will learn more when they repeat the class. On the other hand, isn't it great that the majority of all students at all grade levels learn most of this material! Doesn't it concern you to recognize that about 80% (depending upon the state and institution) of students do not go to college and hence . . . unless they had one of you *great* junior high or high school teachers . . . they won't know about tropical forests, tetanus, AIDS and other STDs, and rising suicides—and that bees and wasps are much more dangerous than snakes!

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