

Knowledge of and Attitudes Toward Evolution in a Population of Community College Students

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Abstract

Much attention has been given to the opposition toward the teaching of evolution at the K-12 level and the movement to include alternative theories, such as Intelligent Design (ID), in the science curriculum. However, very little is known regarding the attitudes of community college students toward the study of evolution and the inclusion of ID in biology courses. This lack of information and faculty reports of increased student resistance to and concern over learning this topic led to a departmental pilot study, in which 342 students were surveyed. The majority of students (272) were enrolled in Principles of Biology, a non major biology course at Miramar College in San Diego, California. The survey was also administered to 70 science majors enrolled in Introduction to Biological Sciences I and II, which are core courses for transfer to university programs. The purpose of this project was to better understand our audience and the knowledge and attitudes students bring with them as they enter general biology courses. As a result of the study's findings several strategies were developed to assist faculty in providing students with a firm understanding of evolution as the main organizing principle of biology, but at the same time alleviate some of the anxiety students may experience when learning about the origin and evolution of life on earth.

Introduction

Among post secondary institutions in the United States, community colleges are the epitome of diversity. Student populations are traditionally more diverse than those found at four year colleges and universities. On a typical community college campus are individuals of assorted academic preparation and ability, age, ethnicity, spirituality, and religious affiliation. Just like any student, the community college student carries his or her personal attitudes and life experiences with them as they enter a course.

As a department, we were interested in the familiarity of incoming students with evolution as a scientific concept and whether or not they believed that the theory is supported by evidence. Also, of significance was to determine the principle source of their understanding of the origin and evolution of life on earth.

In light of the current national debate over the teaching of evolution and the movement behind including ID in the science curriculum, our department was concerned with student

attitudes toward the teaching of evolution and the inclusion of theories other than evolution in science courses. Also contributing to the department's desire to survey students was the notable increase in the last decade in student reluctance to and concern over learning evolution in several of biology courses that are offered on campus. The mere mention of the word as it spoken or written on the board by an instructor seems to cause several in a lecture hall to become wide-eyed and anxious. We were curious as to what was behind this obvious uneasiness seen in students as they begin to learn about evolution.

To further illustrate this point, is an experience a faculty member had with a student enrolled in a biology major course that surveyed the origin, evolution, and diversity of life. The student lingered after the first class meeting and introduced himself as a Chinese Evangelical Christian. He went on to respectfully explain that "He had a choice to make. To either make his professor angry or God angry." He was troubled by the course content and concerned about whether he should drop the course for fear of failing. The faculty member assured him that, although the course was taught from an evolutionary point of view, he would most probably be successful in the course. This student appears to be representative of many other students in biology that are uncertain and, at times, struggle with the study of evolution and their spiritual beliefs.

Survey Administration and Content

The survey was comprised of 16 multiple choice questions, some of which were adapted from a newspaper survey that polled 1,507 adult readers in Ohio regarding the issue of evolution and ID in the K-12 classroom (*Cleveland Plains Dealer* 2002). The students answered the questions using Par Score forms, which were electronically scored and tabulated using a Scantron 2000.

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The instructors were asked to administer the survey at the onset of class during the third to fifth weeks of the sixteen week semester. This was to insure that the information was gathered prior to the study of natural selection and evolution. The only instructions provided to the students involved filling in the Par Score form; students were asked not to fill in their name as the survey was anonymous. For the complete survey and results, see the appendix.

The first eight questions were demographic in nature and assessed student educational background and academic goals. The next four questions measured their knowledge of evolution as a scientific concept, their understanding of the development of life on earth, and the principal source of their knowledge and understanding of evolution. Students were then asked their opinion as to where it was most appropriate to teach views regarding the development of life that differ from evolution. The final three questions assessed student feelings about the learning of only evolution and the undermining of personal morality, their spiritual beliefs, and religious affiliation.

Summary of Survey Results

For 88% of the non majors surveyed this was their first college level biology course. Based on their reported age group (18-20 years) approximately 50% were enrolled in their last biology class within the last 5-6 years; another 39 % (ages 21-30 years) were most probably enrolled in biology within the last 10- 15 years. Slightly over half of the students (61%) students stated that they were somewhat familiar with evolution and approximately the same number of students (58%) believed that as a theory it is well supported by evidence. Science courses were identified

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by 46% of the students as the primary source of their understanding of the origin and development of life on Earth. Stating that their knowledge was gained from religious education and the media (television, newspapers, and magazines) were 27% and 9% of the students, respectively. Slightly less than one half (49%) of the students surveyed acknowledged that all species, including humans, have evolved from earlier species. When asked this question, 17% of the students declared that all of earth's species have remained unchanged since creation. Therefore, for this group of students, evolution was not an option.

When asked in what type of course views regarding the origin and development of life that differ from evolution should be taught, 47% of the students stated in a science course, 24% felt that teaching alternative views should be included in courses other than science courses, and the remaining 27% were unsure.

When asked if they felt learning only about evolution in public schools, such as community colleges, undermines their personal morality or religious beliefs, 24% of the students answered yes; 25% were unsure. A slight majority (61%) of students stated that they believed in a higher power or being. Of those students, 57 % identified themselves as Christian, 15% as Jewish, 5% as Muslim, 1% as Hindu, and 4% as Buddhist.

Four smaller classes of biology majors (70 students total) were surveyed using questions nine through sixteen. Not too surprising, greater percentages of biology majors stated that they were either very familiar (40%) or somewhat familiar (40%) with evolution. A large majority (73%) felt that evolution is well supported by evidence. Although one half of the students stated

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that the course they were enrolled in at the time of the survey was their first college level biology course, they identified past science courses (60%) and the work of scientists (12%) as the primary sources of their understanding of the origin and evolution of life on earth. However, 12% and 8% of these students stated that their principal sources of their knowledge were religious teachings and the media, respectively.

Very interesting, however, is their viewpoint regarding the inclusion of theories other than evolution in biology courses. The percentage of biology majors (49%) who believed these theories should be included along with evolution is almost equal, in fact, slightly exceeds the percentage of non majors (47%) that think alternative theories have a place in a science course.

When asked if learning only evolution as biology majors undermines their personal morality 60% answered no. In addition, 49% stated that they believed in a higher power or being; 23% declined to say. Of the students that affirmed spiritual beliefs, 34% identified themselves as Christian, 13% as Jewish, 4% as Muslim, 0% as Hindu, and 20% as Buddhist. Of those students, both majors and non majors, that identified themselves as being Christian, 31% stated that learning only evolution in a biology course compromised their faith compared with 14 % of Jewish students, 56% of Muslims, 0% of Hindus, and 13% of Buddhists.

Conclusion

What do these survey findings tell us and how can we as faculty use this information to better meet the needs of our students? Foremost, it is imperative that every student exits a biology

course with a firm understanding of evolution as the unifying concept of biology and at the same time come to the realization that learning the material does not necessarily compromise their spiritual beliefs. Students should have a clear understanding of the differences between science and religion. The following strategies were developed to assist instructors to effectively teach evolution to a student population diverse in spiritual beliefs and religious affiliations.

At the onset and throughout the semester faculty should emphasize the objective, testable nature of every scientific endeavor, whether it be in biology, chemistry, or physics. The scientific method is common to all of the sciences, however students learn about the manner in which scientists go about their work typically in introductory biology courses only. Too often, students leave public education with a poor understanding of the process of science (Rutherford 1990). Frequently in the learning of science there is an over reliance on the learning of findings and facts with little emphasis on how a scientist goes about his or her work in an objective manner.

Several polls conducted in the United States over the last decade indicate that an overwhelming number of citizens have a fragmented knowledge of the process of science, particularly when it comes to evolution and the amount of valid evidence that is supportive of the theory. This “low information public” (Nesbit 2005) lacks the motivation and ability to understand the science and politics behind the evolution-religion debate. In short, the public is very confused and there is a belief by many that one has to choose between science and religion.

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Like the public, it is obvious from the survey that community college students are among the confused; students enter the classroom with the notion that science and faith are at odds with one another and media has done a thorough job of furthering this view that controversy exists (NSTA 2006). Although 61% of the students polled stated they are somewhat familiar with evolution, to many it is a hot button issue. Many indicate that the study of evolution compromises their belief system and, perhaps as a means to reconcile those feelings, these students think that alternative theories should be taught in conjunction with evolution in biology courses.

However, there is hope - an almost equal number of students stated they were unsure when asked those questions. These are students that faculty need to reach. As a result of good instruction, students equipped with an understanding of the rational methods of science, optimistically, will not join the ranks of the uninformed citizenry. They will come to the realization that alternative theories, such as ID, cannot stand up to the rigors of science and, therefore, have no legitimate role in the science curriculum.

If college instructors fail in impressing upon their students the importance of evolution, and *only* evolution, to the study of biology, the battle over science and religion that ensues at the K-12 level, may eventually creep into the post secondary level. It may already have. In Florida a proposed bill, “Student and Faculty Academic Freedom in Postsecondary Education (HB837), which if passed sets a statewide standard that students cannot be punished for professing beliefs with which their professors disagree. Professors would also be advised to teach alternative “serious academic theories” that may disagree with their personal views (University of Florida’s

Independent Florida Alligator 2005). According to a legislative staff analysis of the bill, the law would give students who think their beliefs are not being respected legal standing to sue professors and universities. This form of legislation is aimed at all disciplines, not just the sciences. Physicist Lawrence Krause warns that “Evolution is the straw man” and that other scientific disciplines are not necessarily immune to similar attacks waged by politicians and special interest groups. He believes people are challenging science and rationality, not just evolution.

Another strategy useful in diffusing the notoriety that often accompanies the concept of evolution is to eliminate its shock value. To do this and to counter student resistance to the learning of evolution instructors should treat evolution as a recurrent theme throughout the semester. It is not sufficient or pedagogically sound to introduce evolution as the core concept of biology during the first class meeting and then not revisit it until the eleventh or twelfth week of a sixteen week semester. However, this is how the greater majority of textbooks are organized, and how, unfortunately many instructors approach the teaching of introductory biology. Although, it is often said that biology is taught from an evolutionary point of view, in most courses this is not the case. Students, particularly non science majors, see an introductory biology course as being a somewhat tortuous and almost seemingly endless list of unrelated topics to be survived by rote memorization. By revisiting evolution as a persistent premise during or at the completion of studying every major life process (metabolism, cell reproduction, and DNA replication, to name a few) students gain insight into the overwhelming similarities in how the business of life is carried out, and, therefore, possible.

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Students will gain a greater understanding, and therefore acceptance of evolution, if it is infused throughout the semester; woven as a common thread unifying organisms and their life providing processes. This approach also fosters a better overall understanding of the science of biology. For example, the study of metabolism, more specifically glycolysis, is a wonderful opportunity early in the semester to reinforce the concept of common descent which is introduced in the first chapter of every biology book, and, therefore, by a majority of instructors during the week of class. Often eloquently referred to as the “universal prelude”, glycolysis precedes anaerobic and aerobic respiration in everything from bacteria to trees and people. The “recipe” encoded in the DNA of these very diverse organisms reads exactly the same. Why? The students will discover it is the result of common descent, which is the mechanism behind the interrelatedness of all life. To quote Dobzhansky (1973), “Nothing in biology makes sense except in the light of evolution.” Students will gain a greater understanding, and therefore accept evolution, if it is infused throughout the semester; as the central principle of biology. This approach also fosters a better overall understanding of biology.

As a discipline grounded in truth and reason, science is not about opinions, viewpoints, or soundbites. Personal agendas are best left outside the door as one (including the instructor) enters the laboratory or lecture hall. This approach is not only useful in the teaching of evolution, but can be applied to other hot button topics that surface in biology, such as stem cell research and global warming. An experienced instructor is one who leaves the students wondering where he or she stands regarding an issue. The task of the instructor is to provide students a firm foundation in science. A foundation firm enough that, even though, they may not entirely agree with evolution, they understand its central, powerful role in the science of biology.

Appendix

Miramar College Biology Department Student Survey and Results

1) What is your gender?

50% male.
50% female.

2) What is your age?

50% 18-20.
39% 21-30.
9% 31-45.
2% over 45.

3) How many of units of college have you completed?

29% 0-15.
21% 16-30.
22% 31-45.
15% 46-60.
13% 60 or more.

4) What are your academic goals?

2% certificate.
10% associates degree.
67% transfer to a four year university.
21% graduate or professional school.

5) Are you planning to earn a teaching certificate? If so, what type?

14% K-5.
0% 6-12.

6) Is this your first college level biology course?

88% yes.
12% no.

7) If not, how many college biology courses have you completed?

18% one.
3% two.
2% three.
2% four or more.

8) When was your most recent biology course?

68% high school freshman or sophomore year.
11% high school advanced placement (AP) course.
17% college introductory course (Bio 105 or 107).
1% college majors course (200 level courses).

9) Would you say that you are very familiar, somewhat familiar, or not familiar with the concept of evolution?

25% /40% very familiar.

61%/40% somewhat familiar.
13% /10% not familiar.

10) In your opinion, do you think that Charles Darwin's theory of evolution (natural selection) is

58%/73% a scientific theory well supported by evidence-
17%/9% theory that is not well supported by evidence.
24%/10% I am not familiar enough with the theory to say.

11) Which of the following is the principal source of your understanding of the origin and development of life on Earth?

46%/59% science courses in school.
27%/13% religious teachings.
15%/11% the work of scientists.
2%/1% positions of religious or political leaders.
9%/7% the media (television, newspapers, and magazines).

12) Do you think plants and animals have evolved from earlier species? Do you think humans developed from earlier species?

49%/57% plants, animals, and humans developed from earlier species.
24%/14% plants and animals developed from other species; humans were created directly by God or a supreme being.
17%/7% plants, animals, and humans were created by God and remain unchanged from their original form.
17%/11% I am not sure.

13) Which of the following is the best place to teach views regarding the development of life that differ from evolution?

47%/ 49% in a science course.
24%/20% in a course other than a science course.
27%/24% at home or in religious education.

14) Do you feel teaching about *only* evolution in public schools, such as the community college, undermines personal morality or religious beliefs, or not?

24%/13% yes.
49%/60% no.
25%/17% I am not sure.

15) Which of the following describes your religious beliefs?

61%/49% belief in a higher power or being.
7%/4% agnostic.
6%/14% atheist.
23%/24% I decline to say.

16) If you answered a in the above question, what is your religious affiliation?

57%/34% Christian.
15%/13% Jewish.
5%/4% Muslim.
1%/0% Hindu.
3%/20% Buddhist.

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Reference List:

Cleveland Plain Dealer, "Ohio Issue Poll," June 9, 2002.

Dobzhansky, Theodosius, "Nothing in Biology Makes Sense Except in the Light of Evolution."
American Biology Teacher 35 (March 1973): 125-129.

Independent Florida Alligator, March 23, 2005.
<http://www.alligator.org/pt2/050323freedom.php>

Krauss, Lawrence, "When Worldviews Collide: Science and Religion Face Off Again,"
American Physical Society's APS News (April 2006)

National Science Teachers Association. *NSTA WebNews Digest: Education: Evolution*. 2006
http://www.nsta.org/educationnews/&category_ID=319.

Nisbet, Matthew. 2005 *Polling opinion about evolution: Low information public underscores importance of communication strategy*. <http://www.csicop.org/scienceandmedia/evolution/>.

Rutherford, James F., with Ahlgren, Andrew. 1990 *Science for All Americans*. Oxford:
Oxford University Press.

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