

Florida Teachers' Attitudes about Teaching Evolution

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ABSTRACT

A survey of Florida teachers reveals many differences in comfort level with teaching evolution according to the state's science teaching standards, general attitudes and beliefs about evolution, and the extent to which teachers are criticized, censured, disparaged, or reprimanded for their beliefs about the teaching of evolution.

Key Words: Florida biology teachers; comfort with teaching evolution; evolution education.

Before 2008, Florida's science teaching standards did not mention the word "evolution" and only briefly alluded to it as "change over time." This was a large reason why those standards earned an "F" in a national report from the Thomas B. Fordham Foundation in 2005 (Gross et al., 2005). Following this, the Florida Sunshine State Standards for Science were revised during 2007 and passed by the state board of education in February 2008 (Florida Department of Education, 2008). The revised standards include 18 "Big Ideas" threaded throughout each grade level. Since the inception of the standards, Big Idea number 15, Diversity and Evolution of Organisms, has been a major source of contention throughout Florida and was passed only narrowly by the state board of education.

In response to the new standards, Florida politicians opposed to evolution attempted to pass two pieces of legislation, Senate Bill 2692 and House Bill 1483, both entitled the "Academic Freedom Act," which would have opened the door to teaching creationist beliefs as an alternative to the theory of evolution in Florida's science classrooms. Proponents of "academic freedom" legislation claim that teachers are chastised and punished for their religious beliefs, but there are very few data to support or deny this claim. Although neither bill was passed into law during the 2008 Florida legislative session, a new one, Senate Bill 2396, has been introduced into the 2009 session.

The controversy that the theory of evolution by natural selection causes among the general public raises the possibility that it could also be problematic for some of our teachers. It is well documented that a significant number of teachers across the country do

not accept evolution and wish to either teach creationism in addition to it or not teach it at all (for examples, see Aguillard, 1999; Griffith & Brem, 2004; Bandoli, 2008; Berkman et al., 2008; Moore, 2008). Unfortunately, teachers' negative attitudes about evolution can adversely affect instruction (Tatina, 1989; Aguillard, 1999; Rutledge & Warden, 2000), which, in turn, negatively affects student achievement in science.

Our goals in the present study were threefold. First, we wanted to collect data that could help support or deny the claim made by proponents of "academic freedom" legislation that teachers are censured for their religious beliefs. Second, we wished to fill the gap in the literature regarding Florida teachers' comfort with teaching evolution. Third, topics pertinent to understanding evolution, such as variation in a population, inheritance of traits, and differential success at survival and reproduction, are introduced in elementary school; however, most of the data on teachers and evolution have been gathered at the secondary

level. Thus, our third goal was to collect data that could potentially highlight the need for a stronger focus on elementary teachers' views on teaching evolution.

○ Methods Survey Construction

We created a 14-item Likert-type survey designed to determine teachers' comfort level with the inclusion of evolution in Florida's science standards; their general attitudes and beliefs about evolution; and the extent to which teachers are criticized, censured, disparaged, or reprimanded for their beliefs about the teaching of evolution. Some of the questions were derived from prior studies in another state (Donnelly & Boone, 2007), while others were designed to be specific to Florida. In addition, we collected information regarding each teacher's grade level and school type (rural, suburban, or urban). Survey items were given to university faculty science educators for review and modified until it was agreed that the questions were clear and valid. In addition to the Likert items, teachers were invited to comment on their experiences with administrators, teachers, parents, and students regarding the teaching of evolution.

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Participants & Data Collection

Evolution is mentioned in Big Idea 15 in Florida's new science standards beginning in grade 3. For that reason, our target population included elementary in addition to secondary science teachers. Florida teachers were solicited through the Building a Presence in Science (BaP) program of the National Science Teachers Association (NSTA). Of the approximately 1,100 teachers who received the solicitation, 381 responded, resulting in a 35% response rate. Of those, 28 claimed to teach no biology at all, and their responses were excluded from further analysis. Of the 353 remaining participants, 28% taught elementary grades (K–5), 24% middle school grades (6–8), and 48% high school grades (9–12) in urban (21%), suburban (66%), and rural (14%) schools.

○ Results & Discussion

Comfort Level with Evolution in the Standards

Among the 353 responses analyzed, 74% of the teachers agreed or strongly agreed that they are comfortable with the inclusion of evolution in the new Florida science standards, while 20% are not comfortable with it. Moreover, only 62% agree that they will use the new Florida science standards to justify teaching evolution. As of fall 2006, there were 2,662,701 students in Florida's public schools, over 1.6 million of which are in grades whose science standards include evolution (Florida Department of Education, 2007, 2008). Our results indicate that approximately 532,000 or more Florida students who are supposed to be taught evolutionary concepts according to the standards are being taught by teachers who are either not comfortable with evolution or possibly do not teach it at all. This is in spite of the fact that 85% of the teachers who responded to the survey claimed that they understand evolution well enough to teach it.

General Attitudes & Beliefs about Evolution

Only 72% of the teachers agreed that evolution is a central organizing principle of biology, and 17% felt that one can understand biology without learning about evolution. We expected that those who agreed that evolution is a central organizing principle of biology would also agree that it is central to understanding it, and this was generally the case ($r = 0.675$, $p < 0.0001$).

With respect to religion, 66% of teachers disagreed or strongly disagreed that believing in God means rejecting evolution. This is

consistent with common creationist beliefs and indicates that Florida may have a large number of science teachers who hold creationist beliefs. There was a negative correlation ($r = -0.590$, $p < 0.0001$) between being comfortable with evolution and agreeing that believing in God means rejecting evolution. This indicates that the inability or unwillingness to reconcile one's religion with science is a source of discomfort for those teachers.

Seventeen percent of the teachers disagreed that the earth is at least 4 billion years old. Of those, 34% (6% of the total) believe that the earth is between 4,000 and 40,000 years old. Although the age of the earth is not specifically mentioned in Florida's standards until grade 7 (Florida Department of Education, 2008), the Big Idea "Earth in Space and Time" is included in the standards beginning in kindergarten, and by first grade, students are expected to recognize that "some things in the world around us happen fast and some happen slowly" (p. 20).

Differences between Those Who Are Comfortable with the New Standards & Those Who Are Not

When making comparisons between teachers who are comfortable with teaching evolution and those who are not, no difference was found in the proportions of school type (rural, suburban, or urban). However, as can be seen in Table 1, there is a clear difference in general attitudes and beliefs about evolution. It appears that teachers who are comfortable with evolution being in the new standards are more likely to use the standards to justify teaching evolution, and this is likely because they agree that it is a central principle in biology and that students need to understand it in order to understand biology. In addition, while most (94%) of those who are comfortable with evolution feel that they understand it well enough to teach it, only slightly more than half of those uncomfortable with it feel that way. A poor understanding of evolution is likely a major contributing factor to discomfort with teaching it. Further studies are needed to determine whether professional development would help teachers become more comfortable with teaching evolution.

Differences by Grade Level Taught

Because Florida's standards present evolution in much greater detail in grades 9–12, we examined survey responses by grade level (elementary, middle school, and high school; see Table 2). With respect to

Table 1. Differences between teachers who are comfortable with teaching evolution and those who are not.

	Comfortable (%)	Not comfortable (%)
Plan to use the standards to justify teaching evolution	76	12
Feel they understand evolution well enough to teach it	94	51
Agree that evolution is a central principle in biology	89	14
Feel that one does not need to understand evolution in order to understand biology	17	82
Feel that those who believe in God do not accept evolution	3	60
Feel that creationists are more moral than noncreationists	0.4	19
Agree that the earth is at least 4 billion years old	91	47
Have been criticized by teachers/administrators	7	6
Have been criticized by students/parents	24	10
Know of others who have been criticized by teachers/administrators	19	31
Know of others who have been criticized by students/parents	28	25

Table 2. Differences in attitudes about teaching evolution among elementary, middle, and high school teachers.

	Elementary (%)	Middle (%)	High (%)
Comfortable with evolution in the standards	54	66	89
Plan to use the standards to justify teaching evolution	47	62	70
Feel they understand evolution well enough to teach it	69	88	95
Agree that evolution is a central principle in biology	51	67	85
Feel that one does not need to understand evolution in order to understand biology	42	40	21
Feel that those who believe in God do not accept evolution	27	22	5
Feel that creationists are more moral than noncreationists	9	3	2
Agree that the Earth is at least 4 billion years old	61	85	94
Have been censured by teachers/administrators	3	4	10
Have been censured by students/parents	7	14	32
Know of others who have been censured by teachers/administrators	18	14	27
Know of others who have been censured by students/parents	19	21	34

school type (rural, suburban, or urban), the distribution of teachers by grade level was not significantly different. As one might expect, fewer elementary teachers than high school teachers were comfortable with evolution and felt prepared to teach it. Consistent with this, fewer elementary teachers agreed that evolution is a central principle in biology. Interestingly, it seems that more elementary teachers than high school teachers hold creationist beliefs, as evidenced by the responses to the statement that accepting God means rejecting evolution. In addition, fewer elementary teachers agreed that the earth is at least 4 billion years old. Now that evolution has become a Big Idea in Florida's science standards beginning at the elementary level, helping these teachers become more comfortable with and knowledgeable about evolution is increasingly important.

Criticism of Teachers' Attitudes about Teaching Evolution

Slightly more than 72% of teachers reported having never been criticized by teachers and/or administrators at their school or district for how they taught evolution in their classrooms, while only 56% reported the same with respect to students and/or parents. Many reported knowing others who have been criticized by either teachers or administrators (22%) or by students and/or parents (27%). This is consistent with the results of other studies (Tatina, 1989; Chuang, 2003). However, an analysis of the open-ended comments indicates that disparaging comments made by other teachers and/or coworkers were equally distributed among those with pro-evolution sentiments and those without such sentiments. Examples of comments include the following:

"I am the only teacher in my department who teaches evolution. I get anonymous articles in my mailbox from other science teachers promoting intelligent design."

"I have been left videotapes anonymously in my school mail box that promote creationism and denounce evolution."

"A colleague who was outspoken in his born-again beliefs harassed my AP bio students when we were studying evolution. He refused to talk to me."

"I have been criticized, censured, disparaged, and belittled for my beliefs in God as my creator and the creator of the world, in the scientific community at school as well as elsewhere."

"Statements commonly made by fellow teachers: ... 'Any teacher who does not agree with evolution is just plain ignorant.' ... 'We don't need ignorant religious freaks teaching in the public school system.' 'Teachers who believe in creationism are just plain ignorant about how evolution really works.'"

As for reported comments to teachers by school administrators, most were directed at those who teach evolution. Survey responses described administrators discouraging or forbidding the teaching of evolution and, in some cases, indicating a refusal to retain teachers who teach evolution. Conversely, no comments were made about teachers being forced to teach evolution when they did not wish to do so. This clearly reflects the needs for school administrators to become more aware of the importance of evolution as it relates to biology instruction. In addition, these data clearly do not support claims made by proponents of "academic freedom" legislation that teachers who do not wish to teach evolution are reprimanded for their feelings about the topic. Examples of comments regarding administrators include the following:

"My administrators have told me they will not back me with parents if I choose to teach about evolution."

“An administrator expressed his thoughts with me. He felt like we really shouldn’t teach evolution and if we do we should teach intelligent design as well.”

“A former principal, who held strong religious beliefs, called me in to chastise me for mentioning ‘adaptations’ among birds...as was mentioned in our county environmental ed. workbook. The principal made it well known that I was to stop teaching this because it was ‘well known’ that God made the birds the way they were...and that they did not adapt, as I had taught. ‘Your uncle may be a monkey,’ said the principal, ‘but mine was not.’”

“I had a screen saver which said ‘evolution happens’ scrolling across an image of the T-rex Sue and was told to remove it by my principal as it offended the religious sensibilities of a student. I was then told to ‘tread lightly’ when I approached the topic of evolution in class.... In the end I was not rehired at the district.”

Implications for Teaching

Our study indicates that many Florida teachers are uncomfortable with the emphasis on evolution in the state’s newly revised science standards. However, our survey is based on voluntary participation, which increases the possibility of bias in the results. It’s quite possible that we have underestimated the gravity of the situation, because we used a nonrandom sample of teachers which drew from members of the NSTA listserv and the Building a Presence Web system, and members of such organizations are more likely to accept evolution (Weld & McNew, 1999). Teachers’ discomfort with evolution may adversely affect students’ learning through insufficient time spent on the topic and general verbal and nonverbal cues given by the teacher. Therefore, it is important to thoroughly explore the reasons for teachers’ discomfort so that remedies can be developed.

Our results suggest that those who are comfortable with teaching evolution are more likely to spend time teaching it. In addition, they have a better understanding of the content and are more likely to understand ways in which evolution is the unifying theme of biology. Finally, those who are comfortable with evolution are more likely to reconcile their personal beliefs (faith) with their understanding and acceptance of evolution. Thus, it is to the advantage of both teachers and students that something be done to increase teachers’ comfort level when teaching evolution. This is important at all grade levels where evolution occurs in the curriculum, especially at the elementary level. Currently, secondary science teachers are not required to take coursework in evolution in order to obtain a permanent teaching certificate. Elementary teachers are required to have only nine credit hours of any science, including science courses designed for non-science majors. As a step toward increasing Florida teachers’ comfort with teaching evolution, we suggest requiring a course in evolution for secondary science-education majors and incorporating evolutionary content into the required science content for elementary education majors.

Findings from our open-ended responses indicate that, even within schools, teachers do not always agree with each other or with administrators on the teaching of evolution. This can have negative effects at several levels. Dissension in the workplace causes stress,

and in the already high-stress profession of teaching, additional tension can ultimately lead to decreased job performance and even resignation. It is undesirable for students and parents to be exposed to tension between teachers and/or administrators, because it adds fuel to the needless debate over the teaching of evolution, causes confusion among students, and undermines the whole of biology education. In a time when it is more important than ever for people to be scientifically literate, it is vital that teachers and administrators put forth a unified front. We recommend accomplishing this by providing science teachers and school administrators with professional development that focuses on increasing the understanding of evolution and its pertinence to the biological sciences and on teaching controversial topics while fostering a positive classroom environment.

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