
Could 41% of the biology teachers in Louisiana really reject evolution?

Afraid To Discuss Evolution?

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Editor's note: This article contains opinion on topics of broad interest and does not necessarily reflect the views of CHANCE.

People can try to settle intellectual debates in several ways, chief among them raising their voices higher or countering their opponents with statistical arguments. The second strategy is surely better, but only if the statistics are sound. Unfortunately, when it comes to the current debate about teaching “creation science” and “intelligent design” in the public schools, misleading statistics are front and center.

On February 5, 2005, *The New York Times* published the editorial “Afraid to Discuss Evolution,” which argued there is “ample evidence that even when evolution is theoretically part of the curriculum, it is often ignored or played down in the classroom.” To bolster its position, the *Times* cited a “1998 doctoral dissertation [which] found that 24 percent of the biology teachers sampled in Louisiana said that creationism had a scientific foundation and that 17 percent were not sure.” I found these statistics mind-bog-

gling. Could 41% of the biology teachers in Louisiana really reject evolution?

The evidence came from a relatively recent dissertation, so perhaps its findings reflected current-day beliefs. Yet I wanted to know more. Who conducted the study? Did the doctoral candidate have a particular perspective on this usually partisan debate and, if so, was this communicated—inadvertently or directly—to the respondents? Was the sample representative? Was the sample size adequate? Was the response rate high? Every newspaper reader should ask questions like these when evaluating scientific evidence, whatever an article's thesis. So, too, should newspaper writers and editorial boards, including those at *The New York Times*.

From Where Did the Statistics Come?

My curiosity piqued, a Google search—where I punched in the terms “Louisiana, biology, evolution, 1998, AND dissertation”—quickly led to an unpublished 2001 conference paper

published online by the student's thesis advisor, Ron Good at Louisiana State University. There, in the fourth paragraph, were the very statistics cited in the *Times* editorial.

As I was reading the paper, though, the origin of the cited statistics soon became less intriguing than the origin of the dissertation. It turns out the dissertation study was conducted by a doctoral candidate named Don Aguillard, a name that did not (then) mean anything special to me. But a more careful examination of the paper revealed Aguillard was the lead plaintiff in the high-profile case that the American Civil Liberties Union successfully brought to the U.S. Supreme Court challenging the 1981 Louisiana law that required “balanced instruction” (that is, giving equal time to evolution and creation science). The 1987 Supreme Court ruling overturning the Louisiana law is widely known as *Edwards v. Aguillard*. In his paper, Good explained that he “encouraged Don to follow his political activities” and take on this project for his dissertation.

Afraid to Discuss Evolution

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The fights in scattered school districts over whether to teach creationism or its rival, called intelligent design, as alternatives to Darwin's theory of evolution may be obscuring a deeper problem: the tendency of many districts to duck controversy by avoiding or soft-pedaling any teaching of evolution at all. Nobody knows the extent of the problem, but an article by Cornelia Dean in *Science Times* on Tuesday cites ample evidence that even when evolution is theoretically part of the curriculum, it is often ignored or played down in the classroom.

Some teachers duck the subject, lest they get into trouble with school administrators or fundamentalist parents. Others assign a chapter on evolution for reading but avoid any discussion in the classroom. Still others discuss evolutionary concepts without ever mentioning "the E word" to avoid arousing controversy.

Although most state curriculum standards mandate that evolution be taught, and standardized tests typically include questions on evolution, some teachers apparently assume that evolution is a small enough part of the curriculum that their students can get by without mastering the subject. Those students remain ignorant of one of the bedrock theories underlying modern biology.

In some areas of the country, many biology teachers are themselves believers in creationism. A 1998 doctoral dissertation found that 24 percent of the biology teachers sampled in Louisiana said that creationism had a scientific foundation and that 17 percent were not sure. Several surveys have shown that many teachers give at least some instructional time to creationism or intelligent design out of a sense of fairness.

That serves the students and the nation poorly as they enter an age likely to be dominated by biology.

I sat in my office shaking my head; I simply couldn't believe it. How could the lead plaintiff in such a highly visible and politically charged case—whose name was surely well-known to many biology teachers in the state—conduct impartial research on this topic? At a minimum, *The New York Times* readers deserved to know the unnamed writer of this "1998 doctoral dissertation" was someone with a particularly partisan point of view.

Intrigued, I set out to read the study and decide for myself. Maybe it was first-rate. Another online search quickly identified a 1999 paper, based on Aguilard's dissertation, published in *The American Biology Teacher*, the official journal of the National Association of Biology Teachers. But because

that seven-page paper presented only a cursory description of the study's methods, I finally decided to go directly to the source, logging onto the University Microfilms database and downloading the entire dissertation.

Who Were These Biology Teachers?

In his dissertation, Aguilard carefully describes his two-stage strategy for identifying respondents. His laudable goal was to obtain a census of the 775 Louisiana high-school teachers who taught one or more sections of biology during the 1997–98 academic year. He initially wrote to the state's 66 school superintendents asking permission to send ques-

tionnaires to their teachers at school. Fifty-one superintendents, responsible for 563 of the teachers, consented; the remaining 15, responsible for the other 212, did not. In the hope of nevertheless obtaining a census, he then sent letters directly to the home addresses of this latter group of teachers, asking if they would be willing to receive a questionnaire at home; 40 said yes.

So in November 1997, Aguilard mailed his questionnaire to 605 teachers: the 563 whose superintendents consented and the 40 who individually volunteered (and another two whose provenance is never described). After two follow-up reminders, 387 questionnaires were returned. Dividing by the number of questionnaires mailed, Aguilard claims to have a 64% response rate (387/605). But the reality is that every biology teacher in the state was given the opportunity to participate—including the 172 who did not respond to his direct mailing following their superintendent's lack of consent. Given this, isn't it more accurate to describe the response rate as 50% (387/775)? Of course, it sounds better to say that nearly two-thirds of teachers contacted agreed to participate, but the reality is that half did not.

Why make such a fuss about response rates? Even a response rate of 64%—certainly not the worst I've ever seen—doesn't shield a researcher from the possibility of nonresponse bias, which occurs when people who don't participate in a study differ systematically from those who do. Most introductory statistics textbooks (e.g., Moore & McCabe, 2002; Freedman, Pisani, and Purves, 1997) discuss the kinds of errors that can result when portions of a target population are systematically underrepresented in a realized sample. In this study, the nonresponse bias might cut both ways: Some teachers who believe in creationism might be unwilling to respond to a survey explicitly focused on the teaching of evolution (producing an underestimate), while others might be especially willing to respond so as to get their views across (producing an overestimate). Either way, it's unlikely that the 388 teachers who didn't respond share the same distribution of views as the 387 who did. And if the sample isn't representative, what do the summary statistics actually tell us?

**Table 1—Results from the Survey Described in
The New York Times Editorial**

Question	Yes	Not Sure	No
# 15: "Do you think that the theory of evolution has a valid scientific foundation?"	84% (n=323)	10% (n=39)	6% (n=23)
# 19: "Do you think that creationism has a valid scientific foundation?"	24% (n=93)	17% (n=64)	59% (n=227)

Did the Researcher Appear Impartial to the Respondents?

Had the response rate been the only problem, I might have let the matter drop, but unfortunately, it gets worse. In his initial cover letter to the superintendents and the 212 teachers whose superintendents did not permit questionnaires to be delivered at the school site, Aguillard wrote,

"I am interested in studying attitudes of high school biology teachers regarding evolution instruction during the 1997–98 school year. ...The National Association of Biology Teachers (1985), an organization of science teachers, in a position statement on teaching evolution stated that "Teaching biology in an effective and scientifically honest manner requires classroom discussions and laboratory experiences on evolution."

And in his cover letter to the 605 teachers who were sent questionnaires, he wrote,

"Enclosed is a questionnaire designed to collect data regarding several variables related to the teaching of evolution in Louisiana. ...In appreciation for your participation, copies of the *Proceedings of the 1992 Evolution Education Research Conference*... will be forwarded to the first fifty respondents."

If there was a superintendent or biology teacher in Louisiana who didn't recognize Aguillard's name from the Supreme Court case, his pro-evolution position certainly seems clear in these cover letters. Decades of research on questionnaire design demonstrates the impact of researcher bias on questionnaire responses. Impartial? I'd say not.

Did 41% of the Teachers Sampled Really Reject Evolution?

So with these caveats in mind, let's examine Aguillard's survey results (Table 1). In his 58-item questionnaire, he wisely asked teachers their views about both evolution and creationism (although it's worth noting the two questions did not have a parallel structure—evolution is presented as a 'theory' whereas creationism is not). In presenting his findings, the *Times*, like Aguillard's advisor, Good, chose to focus on the percentage of teachers who think creationism has a valid scientific foundation, noting that 24% of the respondents said yes and another 17% said they weren't sure. These are surely the more 'sensational' statistics in his dissertation.

But given that the *Times* editorial was lamenting teachers who avoid discussion of evolution, it might have been useful to present teachers' views about this theory, which were decidedly more positive. In fact, 84% of his respondents agreed that the "theory of evolution has a valid scientific foundation," while only 6% said "no" and another 10% said "not sure." That's a total of 16% of his (possibly nonrepresentative) sample, not the 41% cited in the *Times*. I agree that 16% is not trivial, but I don't think it rises to the level of mind-boggling.

What Should We Conclude?

The debate over the teaching of creation science and intelligent design continues to escalate. As of late August 2005, more than 25 web sites and blogs have reproduced this *Times* editorial either through excerpts to these statistics or a link to the *Times* web site. None of these postings appear to have examined the source of the statistics.

It's also worth noting that the statistics are being cited by partisans on both sides of the debate, with evolutionists lamenting the state of affairs (as did the *Times*) and creationists taking comfort in the large number of biology teachers sampled who apparently agree with their position.

The *Times* concluded its editorial by writing that failure to teach evolution may "serve the students and the nation poorly as they enter an age likely to be dominated by biology." I happen to agree with that conclusion, but not because of the data the editorial board used to support it. We're already in an age dominated by statistics. Maybe the *Times* should have worried about its failure to serve the students and the nation by not adhering to good statistical practice. Whatever your point of view on this topic, I think we all can agree that using sloppy statistics to debunk pseudoscience can be just as bad as pseudoscience itself. ☐

References:

- Aguillard D. 1999. Evolution education in Louisiana Public Schools: a decade following *Edwards v. Aguillard*. *The American Biology Teacher* 61(3): 182-188.
- Aguillard D. 1998. An analysis of factors influencing the teaching of biological evolution in Louisiana public secondary schools. Unpublished doctoral dissertation, Louisiana State University.
- Dillman D.A. 1999. *Mail and Internet Surveys: the Tailored Design Method*. New York: Wiley.
- Fowler F.J. 2001. *Survey Research Methods*, 3rd edition. Newbury Park, CA: Sage.
- Freedman D.N., Pisani R., and Purves R. 1997. *Statistics*, 3rd edition. New York: Norton.
- Good R. 2001. Evolution and creationism: one long argument. Paper presented at the Sixth International History, Philosophy, & Science Teaching Conference. Denver, CO. Available online at <http://nosha.secularhumanism.net/essays/good2.html>.
- Moore D.S. and McCabe G.P. 2002. *Introduction to the Practice of Statistics*, 4th edition. New York: Freeman.