An Ethical Issue Related to Teaching at the Undergraduate Level
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This paper discusses an incident that occurred at a particular college, but likely represents the issues new faculty may face in their early years of teaching. The ethical questions include, what will happen to me when I confront a senior faculty member with errors in their student's work, and do I allow a student to do something that I know is wrong, but nobody else knows or is likely to discover. The incident discussed happens to involve a master's degree candidate at the school but just as easily could have involved an undergraduate working on an honors thesis.

The spring term, 1993, was in my fourth year of teaching at Smith. I had been promoted to associate professor in the Mathematics Department at Smith College, two years earlier, but was still untenured. I was the only statistician on the faculty at the College; however, introductory statistics was also taught in the Psychology, Economics, and Exercise and Sports departments by faculty in those departments. In the past, students from some of those departments had found the statistics taught in the Mathematics Department to be "too theoretical," and, as a result, the departments initiated their own applied statistics courses tailored for their students. They used examples only from their own fields and paced their introductory courses for students with mathematics backgrounds at the level of high school algebra and geometry. By the time I arrived at Smith in 1989, the statistics courses in these other fields were well established, and my course enrollments consisted mostly of a few adventurous mathematics majors willing to try a course outside the mainstream of mathematics and some farsighted pre-med and biology majors who knew they would need some statistics in graduate school. To build demand for my courses and to distinguish applied from theory courses, I reorganized the statistics we offered, creating a two-semester applied-statistics sequence for students who had taken one semester of college-level mathematics, a two-semester mathematical statistics sequence for mathematics majors who had taken multivariate calculus, and a basic-level introductory applied course for students who had at least three years of high-school mathematics.

The Biology Department did not have their own statistic course, and the department was conflicted about whether to require their students to take statistics. One of the Biology faculty, convinced that all biology students should take statistics, volunteered to teach one of the lab sections of my introductory applied stat course in the spring of 1992. By the spring of 1993, the Biology Department agreed to strongly recommend, but not require, my course, Basic Statistics, to their majors. To encourage their students to take the course I taught from the biostatistics text, *Statistics for the Life Sciences*, by Myra Samuels. The course met for seventy-minute lecture/discussion sessions three times each week and for an eighty-minute lab each week. We held two lab sections, one for the biology students and one for everyone else.

The recommendation of the Biology Department and my choice of textbook appeared to have little influence on enrollment. Basic Statistics was an unusually small class in the spring of 1993, with only eight students, five biology majors including one graduate student in the Biological Sciences who asked to audit the course, and three others. I taught the one lab section of the course. Although the graduate student's mathematics background included only high school algebra and was taken many years earlier, I agreed to let her participate in the course. She attended class fairly regularly, but did little of the homework and scored 65 out of 100 points on the first quiz. She stopped taking the quizzes and tests after the first quiz.

What probably motivated the graduate student's regular attendance was the term project for the course. All students in my introductory statistics classes complete a term project that requires them to design a study, collect and analyze the data, and write a report. The few graduate students

who have taken the course over the past 20 years usually ask to use their masters-thesis data as the basis for their project. Because their thesis projects conform to my requirements that the study be their own original work, that they design the data collection and collect the data themselves, and do their own analysis, I agree to allow them to use their thesis data for the class project. It appeared that this graduate student's primary goal for the course was to learn enough statistics to complete the analysis of her thesis data.

Although this student had at least two thesis advisors, one in the Biology Department at Smith and another at The University of Massachusetts in Amherst, only a half-hour bus ride from our campus, she consulted with me regularly throughout the spring term to discuss her thesis. She told me that her advisor did not know much about the field of statistics and did not see the need for them in her thesis, but she was convinced that she needed to apply statistical methods to analyze her data, and she persisted. After my course ended in May, she continued to drop by my office during the summer for consulting on her thesis. We discussed methods for testing her hypotheses, and she would do the tests herself, coming back regularly to show me the results and to discuss interpretations of what she found. Primarily she used t-tests, testing for differences in group means. The summer ended, and I did not see her for quite a while. I now believe she was writing her thesis during that period.

In early October, she brought in a table of her final results. She wanted me to explain how to discuss these results in her thesis. The table was formatted for a publication, and it appeared that she had put some effort into its title, labels, and formatting. She considered the table to be in final form. Unfortunately, it contained only a selection from the t-tests she had conducted, particularly those t-tests that found statistically significant differences between the group means tested. I pointed out that she had conducted many more tests than the ones reported in the table, and I objected to selecting and reporting only the significant results. I explained the problem of multiple testing in statistics and the importance of using a procedure to control the family-wise error rate. I emphasized that it was misleading to the readers to report the tests to be significant without adjusting for multiple comparisons, and I taught her the Bonferroni method of adjustment because it can be carried out easily and quickly. The student was unwilling to adjust the results or change the table. She said her biology advisors were pleased with her work and wanted the table, without changes, in the thesis.

At that point I was unsure what to do. I could see few options. At Smith, theses have one or two thesis advisors who are selected by the student and regarded by the College as the student's mentors throughout the research and writing process. Once the thesis has been completed two readers from the department evaluate the thesis. In the final step of the approval process for the thesis research, the student gives a public presentation of her work and answers questions, first from audience, and later from the thesis committee in a private meeting between the committee and the student. I had never been invited to become a member of this student's thesis committee or to read and comment on the completed thesis. I was not invited to her talk. I know that her local advisors knew she was meeting with me to discuss her data analysis, but neither of them asked for my opinion of her work. As far as they were concerned, my relationship with the student was entirely unofficial.

Given my untenured status at the College, my unofficial status with regard to this thesis, which was not conducted in my home department, and of which my mathematics colleagues knew nothing, and the fact that her official thesis advisor was a very senior member of the Biology Department, I could have easily just dropped my concerns and said nothing more. Only the student knew of my dissatisfaction with her work, and none of her official advisors recognized that what she had presented was potentially misleading for other researchers.

 The other option I saw at the time was to withdraw from the informal consulting arrangement and tell the student that if she wanted further help she would have to find it elsewhere. If I withdrew, I would have to make clear to the student that I was actively withdrawing. Without some active statement from me, she could easily assume that our meetings had ended, and that she would not have to see me again. Actively withdrawing would require explaining to the student and her advisor that I was withdrawing from our association and why I was withdrawing. I also felt the need to tell them that if she reported her results in the table she had shown me, I did not want my name associated with the work. My reputation as a statistician could be harmed by allowing sloppy work to be associated with my name.

In the end, there was no choice to be made. Only the second option "felt right" to me. I wrote a letter to the student and sent a copy to her thesis advisor explaining the matter. The letter stated, "I'm writing to tell you that I do not want you to acknowledge any of my assistance in the planning or analysis of your master's thesis from Smith College in any papers that you may give at professional meetings or in any other public forum, or in any papers you may publish from your thesis research." The letter also explained that I withdrew from the consulting arrangement because her reporting of hypotheses test results without adjustment for multiple comparisons is misleading, and that she had "misused the statistical analysis" I helped her to perform. I added that "I hope that you will rethink your analysis before publishing it outside of Smith."

Within ten days of sending my letter, I received a reply from the student. I was impressed by the differences between her attitude toward my suggestions when we discussed the issue in my office and the thoughts expressed in her letter. She thanked me for my time and my advice and expressed her appreciation for my comments about "determining statistical significance in an experiment involving multiple comparisons." She went on to explain that she objected to the Bonferroni method only because it was too conservative and that she would use would use a "sequential Bonferroni method" (Rice, 1989) instead. Apparently, my letter had helped her realize that multiple comparisons was an issue statisticians felt strongly about, and she responded appropriately by learning more about the issue.

In 1998, the student published a paper describing her thesis research. In the paper she used non-parametric tests, adjusted the p-values for multiple comparisons, and discussed the conservative approach she used to avoid making type 1 errors. Her thesis advisor did not hold it against me that I had created an issue where none had been obvious to him. He seemed to consider it a private issue between me and the student. I earned tenure, and eventually promotion, in my department and I forgot about the controversy. My choice to withdraw from our collaboration appears to have been the right choice in that particular situation. There were no consequences regarding my appointment at the College, and the student learned something important. Had I not made an issue of the problem, in person and by writing my letter, the student would not have learned about the issue of multiple comparisons. She would not have seen it as an important issue, and she would not have adjusted the conclusions she drew from her data analysis, and thus possibly misleading future researchers in the field.

Looking back, would I do things differently today, if confronted with a similar situation? My answer has to take into account the very different perspectives of a tenured full professor with a long history at the college and of an untenured associate professor new to the college. Nonetheless, I wish I had considered going to each of the student's thesis advisors to explain the situation to them. Even better would have been bringing the student into that conversation if it could have been conducted in a spirit of mutual inquiry, each trying to understand the perspective of the other.

From a wider perspective, we, as senior faculty, need to recognize the isolation new faculty sometimes experience and their need for mentoring. Mentoring by a senior faculty member in another department who has expertise in a related field and knows the culture in the school can go a long way towards helping junior faculty resolve these kinds of issues.