

Ethics In The Introductory Statistics Course

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1 Description of the Activities

The grant supported the inclusion of three activities into the statistics course, Math 52. I closely followed the original proposal with a couple of exceptions. I originally proposed to spend two days in class on ethics topics with the other activities integrated throughout the term. I spent three and a half days on ethics topics, and the planned projects were mixed with statistics and ethics.

First, we took part in three and half days of explicitly exploring some of the ethical concerns in statistics. The focus was on the related issues of communicating statistical results. The activities started by looking at the differences in media reports and the original scientific paper. We then examined some basic principles in how to share results in both graphical and numerical contexts.

The second set of activities were integrated into the course projects which consisted of a set of extended problems. The statistical aspects of the problem included issues in experimental design, hypothesis testing, and meta-analysis. Students were expected to write their results in ways consistent with our discussions in the in-class ethics segments. Additionally, explicit ethics questions were included in the projects that required that the students explore the meaning and importance of p -values and the power of a test. These questions revolved around some of the controversies and issues that do not have common answers in different disciplines.

Finally, the ethical dimensions of how to communicate statistical results were integrated throughout the course. Whenever we explored a new statistical test or procedure we carefully explored how to state the results in ways that minimize the possibility of misinterpretation yet remain concise. For example, when introducing the idea of statistical inference we also explored why it is important to explicitly state confidence levels when stating the null and alternate hypothesis and then carefully explored how to state the conclusions after performing the relevant statistical test.

2 Challenges

I did not experience any major problems with respect to the classroom and evaluation activities. It was a little bit clumsy in this first iteration, but the students did not express any discomfort with the material.

The preparation, though, required more time than I had anticipated. Relatively little material is available that explicitly focuses on the topics explored that is at an appropriate scientific and mathematical level. I was surprised. The activities that we explored are generally explicitly addressed in the advanced training of professional statisticians. The issues do not require advanced

knowledge of statistics, but most of the materials that I found make use of contexts that assume a relatively sophisticated understanding of probability and statistics.

I was able to find a couple of papers that explored the basic issues of the interpretation of type I and type II errors. One paper focused solely on the ethical issues associated with the power of a test, and this paper seemed to be accessible to the students. Another paper focused on the interpretation and limitations of p -values, and this paper presented more difficulties for the students. Interestingly, the paper included at least one factual error. Some students had a visceral reaction to the idea that a published paper could include such an error.

3 Assessment

I suspect that the students will provide mixed reviews of the ethics component of the course. We were not able to cover much of the material in depth due to time constraints. The three days spent on the topic seemed a bit disjoint from the rest of the course, and I am not yet comfortable exploring this topic in this context.

The results, however, did meet my expectations. One of my goals for taking part in the program was to motivate the issues of how to state statistical results and explicitly explore why it is important. In this regard, I believe it was a success. Students were much better in carefully stating their results in ways consistent with the practices of the profession. More importantly, our discussions on this topic were less on the mechanics and basic wording and more on why we use the language that we use. We were able to focus on the general principles such as what it means to state a result in the context of uncertainty and the principle of insuring that others can replicate and confirm calculations.

4 Continuation

The hardest part was to find and collect the relevant materials. I will certainly make use of these materials in the future.

I do plan on making some changes, though. A large portion of the ethics materials were done as a separate module. In the future I would like to integrate the ethics topics more carefully throughout the course. For example, the ethical issues of graphical representation would be included in the section on data exploration, and the materials used for the exploration of p -values would be integrated into the section on statistical inference.

5 Lessons

The first and most important thing that I have learned is that this can be done. I knew that it would require a good deal of time, but more preparation time

was required than I had anticipated. As indicated above, I was surprised at how few materials are available in which the probability and statistics context is at an appropriate level for an introductory class.

Now that the materials are in place, however, I do feel that an obstacle has been scaled. The problem of finding new case studies does not require as much time, so the effort in finding the primary materials should pay off in the future.

I had a good idea of what I wanted to do and wanted to use the ethics topics as ways to reinforce ideas central to the discipline and relevant to the course. Knowing the goal and having an endpoint in mind, I was free to focus on collecting materials. This made it easier to achieve the goal despite the large time commitment.

Finally, the effort required time in class that would normally be spent on a different topic. The extra time in class gave us the opportunity to focus on a few basic ideas and principles. This freed up time in other aspects of the class. For example, less time was used in class discussing the small details on how to state results because the students had a better understanding as to why certain practices have evolved.

6 Advice

I do not have much in the way of advice. The only thing I can say is that it is worthwhile and can be done. I had a good idea of what I wanted to do, and my efforts focused on accomplishing the goals.

The only thing I would change is to integrate the exploration of ethics throughout a course rather than spend a few days explicitly addressing a number of issues. Such an approach is a subtler way to introduce the ideas, but it can be a way to motivate important topics in class.