Case Studies in the Mathematical Statistics Course

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Abstract

We have developed a model for teaching mathematical statistics through detailed case studies. We use these case studies to bridge the gap between statistical theory and practice, and to help students develop an understanding of the basic ideas in mathematical statistics. We also use them to motivate students to explore the concepts of statistics. Although we strongly advocate teaching mathematical statistics through case studies, there are many challenges that arise from this approach. In this paper, we describe how we find case studies and incorporate them into the course. We outline the challenges that we face in adopting this approach, and discuss our efforts to overcome these challenges.

Keywords: undergraduate statistical education; pedagogy

1 Introduction

Cobb and Moore [2] call for the design of a better undergraduate mathematical statistics course that both strengthens students' mathematical skills and integrates data analysis into the curriculum. Others have called for similar courses (Hogg [11], Kempthorne [12], Moore and Roberts [13], Mosteller [14]). But, it is a challenge to bring data analysis skills into the mathematical statistics course. We advocate that we are better able to achieve this integration by including case studies in the curriculum.

We (Nolan and Speed [15]) have developed a course that teaches mathematical statistics through in-depth case studies. Our approach integrates statistical theory and practice in a way not commonly found in an undergraduate course in mathematical statistics. Each case study centers around a scientific question; it contains a dataset to address the question, and we develop statistical theory in order to answer this question. There are three salient aspects to our case studies approach:

- The problem central to the case is introduced first, and a rich context for the problem and a description of data collected to address the problem are provided before any relevant statistical theory is discussed.

- The solution to the problem raised in the case study is not provided to the students. In fact, there are many possible solutions which may use different types of analysis.