

## Suggestions for Teachers of Statistics

- Emphasize that uncertainty is often unavoidable. So we need to:
  - Seek to know where it may occur
  - Try to estimate how large it is.
- Be willing to say, "I don't know" when appropriate.
- Point out the differences between ordinary and technical uses of words.
- Be sure to include discussion of skewed distributions and how to deal with them.
- Emphasize that every frequentist statistical inference technique depends on model assumptions.
  - Form the habit of checking if the model assumptions are reasonable before applying a procedure.
  - Expect your students to do the same.
  - Give assessment questions that ask the student to decide which techniques are appropriate.
  - Discuss robustness of procedures.
- When a test fails to reject the null hypothesis, do not accept the null hypothesis unless a power calculation has shown that the test will detect a practically significant difference, or unless there is some other carefully thought out decision criterion that has been met.
  - Expect your students to do the same.
- Remember, and emphasize, that one study does not prove anything.
  - In particular, do not use strong language such as "We conclude that ...", "This proves that ...", "This shows that ... is ...."
  - Instead, use more honest language such as, "These data support the claim that ..." or "This experiment suggests that ..."
  - Expect your students to do the same.
- In introductory courses, try to caution your students about the problems with multiple inference and the file drawer problem, even if you can't go into detail.
- In advanced courses, be sure to discuss the problems of multiple inference and the file drawer problem.
- Even though you cannot include thorough coverage of the topic of wording questions in a general statistics course, be sure to mention it, give some examples, ask some questions on it on exams, and have students pay attention to question wording if they are designing or carrying out a study.
- Try to choose a textbook that includes the points above. The introductory textbooks by De Veaux, Velleman and Bock generally are good for this at their level. I occasionally post brief reviews of statistics textbooks on my blog at <http://www.ma.utexas.edu/blogs/mks/>
- The article Twenty Tips for Interpreting Scientific Claims, by Sutherland, Spiegelhalter and Burgman (*Nature* 20 November 2013, pp. 335 – 337, <http://www.nature.com/news/policy-twenty-tips-for-interpreting-scientific-claims-1.14183>) gives a list that is good to emphasize in courses.
- Make use of web demos that can help students understand concepts and cautions. There are links to some at the website for this SSI course, and some (keyed to one of the textbooks by De Veaux, Velleman and Bock) at

<http://www.ma.utexas.edu/users/mks/M358KInstr/M358KInstructorMaterials.htm>  
(scroll down to near the bottom of the page).

- For more suggestions for introductory courses, see American Statistical Association (2005, reformatted 2010), *Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report* (can be downloaded from <http://www.amstat.org/education/gaise/index.cfm>)
- Make use of other resources for professional development for statistics teachers:
  - The Consortium for the Advancement of Undergraduate Statistics Education (CAUSE, <http://www.causeweb.org> offers workshops, webinars, and links to resources for statistics teachers.
  - The Journal of Statistics Education is available online (<http://www.amstat.org/publications/jse/>) to anyone for no charge. It publishes three issues per year containing peer-reviewed articles related to statistics education. Their home page has information on how to receive e-mail announcements when new issues are published, as well as links to an Interactive computing Archive, a Data Archive, and other resources.
  - Join the American Statistical Association (<http://www.amstat.org/>) and its Statistical Education Section. The latter will give you access to a listserve that can be useful for asking questions about teaching statistics.