Examining the Introductory Statistics Course for Business and Economics through Its Textbooks

John D. McKenzie, Jr.
Babson College, Babson Park, MA 02457

Abstract

In this session, each panelist will respond to the following two questions for two popular textbooks and their supplements: What is missing? What isn't needed? To answer these questions, each panelist will present ordered lists of 10 items. [The top 5 of which are listed below. The bottom 5 are available upon request from the author.] By these critiques, they will give their opinions on all aspects of the introductory statistics course, not just the course for business and economics. Hence, they will discuss topics (content), techniques (delivery), and technology (statistical software, datasets, course management software, applets, etc.). There will be ample time for audience participation at the end of the session.

Key Words: content; curriculum; delivery; pedagogy; technology; topics

1. Devore on McClave, Benson, and Sincich (2005)

What is missing?

1. An adequate (let alone distinguished) early section on data collection as appears in David Moore's books.
2. More challenging exercises.
3. A discussion of the three basic types of statistical intervals – confidence, prediction, and tolerance – and inclusion of the one-sample t prediction interval for a single future observation.
4. One-sided confidence intervals and their relation to one-tailed tests, and one-sided prediction intervals.
5. Information on power and type II error probabilities for tests concerning a proportion, and for one- and two-sample t tests with examples from software.

What isn't needed?

1. The rejection region method for testing hypotheses (except for brief mention in connection with beta and power calculations) – go with P-values!
2. The 20 pages on distribution-free ANOVA and Spearman's correlation coefficient (each of these could be described concisely in a "mind-expanding" exercise).
3. The 5 pages on the uniform distribution (but why no mention of the lognormal distribution?).
4. Using Technology subsections, which take many (expensive to produce) pages to describe the use of SPSS, MINITAB, Excel, and PHStat2. Relegate these to supplements which can be provided to individual adopters for duplication and distribution (most faculty members would use at most one of these packages, so there is currently much extraneous material).
5. Using the TI-83 Graphing Calculator subsections. Again I'd suggest a supplement containing this material; perhaps I'm wrong, but I'd guess that most 4-year colleges do not use graphing calculators in the course.

2. Devore on Moore et al. (2005)

What is missing?

1. A section on descriptive multiple regression in Chapter 2, the early descriptive regression chapter (this will give a bit of exposure to those taking courses which don't have time for inferences in regression).
2. One-sided confidence intervals and their relationship to one-tailed tests, and also distribution-free confidence intervals corresponding to the one- and two-sample Wilcoxon tests.
3. Early mention of the "other" two types of statistical intervals – prediction and tolerance – along with the one-sample t PI for a single future observation from a normal population distribution.
4. More examples and exercise scenarios (within a chapter, a single scenario may be the basis for many examples – e.g. all eight examples in Chapter 10 relate to the same scenario). Students need to see variety to become convinced of wide applicability! And what should be material for just one or two exercises is too often instead spread out over five or six, inflating the exercise count.
5. More sections within chapters to break the material up to a greater extent (e.g. Chapter 7 on Inference for Distributions covers 72 pages in

only 3 sections, and the chapter on time series has only 2 sections).

What isn't needed?

1. The rejection region approach to hypothesis testing, except briefly in connection with β/power calculations.
2. Most of the coin and dice examples in the probability chapters (to be replaced with more compelling and less contrived problem scenarios).
3. The distinction between upper case letters for random variables and lower case letters for observed or calculated values, which is used inconsistently in the text – e.g. $\overline{X}$ and $\overline{x}$ are both used for the sample mean, but only *s* for the sample standard deviation.
4. Double subscripting for ANOVA data.
5. The two-sample t material at the outset of the single-factor ANOVA chapter.

3. Mansfield on Johnson and Wichern (1997)

What is missing?

1. A current revision is needed. The authors make good points. Their contributions to teaching at this level can still be of value.
2. A style upgraded.
3. Appeal to Gen-Y.
4. Use the computer for calculation of some summary statistics, particularly for regression.
5. Place more emphasis on interpreting the results and making decisions.

What isn't needed?

1. Exercises that show the relationship between various formulae; (e.g.: Show SSE = $S_{yy} - b^2_{1*}S_{xx}$). Page 562.
2. Random number tables. Use computer.
3. There are too many wordless generic problems. Add more "language of the problem" situations.
4. Normal approximation to the Binomial. Keep however problems about the sampling distribution of sample proportions for large W enough n.
5. Reduce some of the fundamental rules of probability. From a two-way table for two categorical variables, use conditional probabilities and marginal probabilities to assess the existence of a dependence.

4. Mansfield on Weiers (2005)

What is missing?

1. A "time limit" for the author for what can be covered in a one semester course. This book is designed for two semesters, the market may be moving away from this for introductory courses.
2. A more appealing motivation is needed in the introduction of the regression chapter that will excite introductory students to the many uses of regression analysis.
3. A reduction in the level of computational details in some sections, such as two sample tests and regression.
4. A refocus of hypothesis testing toward using confidence intervals instead of the traditional formal steps based on rejection regions.
5. Use of square root and log transformations for removing curved patterns in regression data. (Use of a logarithm is mentioned in a discussion on exponential growth.)

What isn't needed?

1. Finite population correction factors are overkill.
2. Full details of the Poisson and exponential distributions. Keep the pictures to illustrate other types of distributions, but forgo the computation of probabilities.
3. Normal approximation to the Binomial. Keep however problems about the sampling distribution of sample proportions for cases with large enough n.
4. Many of the non-interpretive equations such as the "machine formula" for standard deviation and the double subscripted notation in regression could be reduced or eliminated.
5. Coverage of basic probability can be reduced. Put more emphasis on data analysis and inference leading to decision making in the face of uncertainty.

5. Ord on Berenson, Levine, and Krehbiel (2006)

What is missing?

1. Systematic linkage of diagnostic testing to regression model building. Topics such as quadratic regression and transformations are introduced without clear reasons as to why they should be considered.
2. Chart relating p-values and critical values. Students often find it hard to relate the two approaches.
3. Shortage of more challenging problems in some areas. However, existing problems could be "souped up" if necessary.

4. Upper and lower percentage points for t-tables. Also useful to indicate one and two tail probabilities, as guide to weaker students.
5. Early treatment of index numbers as weighted average. Much of the data students will encounter is of index number form; some basic knowledge of construction is needed.

What isn't needed?
1. Use of z tests then t tests. We rarely if ever use z outside QC applications. Go straight to t.
2. Discussion of residual analysis starts too early. Get the students comfortable with regression and then link residual and diagnostic analysis to model building.
3. Price around $130. Frequent revisions clearly in W publishers' interests, but we presumably reinforce that by always choosing the new editions.
4. Book too big and heavy (about 5 pounds). Tendency to include all topics even though material provided greatly exceeds what can be covered in a first course.
5. Various special topics. Transfer to CD and reduce book size.

6. Ord on Bowerman and O'Connell (2003)

What is missing?
1. Systematic linkage of diagnostic testing to regression model building. Topics such as quadratic regression and transformations are introduced without clear reasons as to why they should be considered.
2. Probability plots. Readily provided by some packages and assist in diagnostic checking.
3. Shortage of simple "how to" problems in some sections. Having used the book as a text, my colleagues and I found we had to supplement the text problems on a number of occasions.
4. Upper and lower percentage points for t-tables. Also useful to indicate one and two tail probabilities, as guide to weaker students.
5. Correlation should be introduced earlier. The whole package is very comprehensive.

What isn't needed?
1. Use of z tests then t tests. We rarely if ever use z outside QC applications. Go straight to t.
2. Discussion of residual analysis starts too early. Get the students comfortable with regression and then link residual and diagnostic analysis to model building.
3. Two different versions of normal tables. Very confusing for students; tables in book should match output from recommended packages. Full table makes calculations more transparent.
4. Price around $130. Frequent revisions clearly in publishers' interests, but we presumably reinforce that by always choosing the new editions.
5. Book too big and heavy (about 5 pounds). Tendency to include all topics even though material provided greatly exceeds what can be covered in a first course.

7. McKenzie on Anderson, Sweeney, and Williams (2005)

What is missing?
1. Excel warning.
2. Cumulative normal table approach instead of half-cumulative normal approach. Use the approach used by stat packages.
3. Data. Need for more real, not toy, raw data.
4. Varied exercises. More than just pluginski/clickinski exercises.
5. Concepts instead of mechanics. Are we teaching a statistics course or a computation course?

What isn't needed?
1. MTB13 not MTB14. For example, graphs.
2. Excel. Why? Graphs, random numbers, computations, missing data, etc.
3. Math orientation. Venn diagrams, set notation, counting rules, etc.
4. Too many short-cut formulas. Also its quartile formulas.
5. Regression chapters after ANOVA chapter. Not a general education textbook.

8. McKenzie on Keller (2005)

What is missing?
1. Cumulative normal table approach instead of half-cumulative normal approach. Use approach used by stat packages.
2. Time series orientation.
3. Process orientation.
4. Subsequent use of graphs after initial chapter. EDA, condition checking, communication, etc.
5. Ethical issues.

What isn't needed?
1. Stronger warning needed for Excel, not just computations. Graphs, random numbers, missing data, etc.
2. CD topics, such as Excel workarounds, grouped data, counting rules, etc.
3. Summary statistics for raw data appendix.

4. Regression chapters after ANOVA chapter. Not a general education textbook.
5. Decision analysis chapter. Just an introduction.