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Abstract

Bernard L. Madison, Stuart Boersma, Caren L. Diefenderfer, and Shannon W. Dingman. *Case Studies for Quantitative Reasoning: A Casebook of Media Articles* (Pearson Learning Solutions, 2012). 215 pp. ISBN 9781256512875.

Concisely organized and timely to a tee, *Case Studies for Quantitative Reasoning* contains a wealth of articles and exercises to promote higher-order thinking in any course where quantitative literacy is a goal. The text is a self-contained package complete with just enough mathematics to ensure that all students can join in. It contains a total of twenty-four case studies, each of which highlights how numbers appear in day-to-day media. The text is broken into six broad mathematical topics, each of which includes any background mathematics necessary for reading. Each individual study includes warm-up exercises and follow-up questions that demand critical thinking. Notwithstanding the elementary mathematics prerequisite to read the text, the topics and questions are sufficiently challenging to keep a class – and accompanying instructor – engaged for an entire semester.

Keywords

book review, numeracy, quantitative literacy, media articles

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Cover Page Footnote

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Introduction

Each day, students of all ages are inundated with numbers. These confrontations – be they with media, doctors, or advertisers, among others – have a subtle impact that accumulates and becomes quite significant in the long run (e.g. Steen 2001, 2004; Madison and Steen 2003). Indeed, one’s quantitative literacy (QL), or ability to perform math in elementary contexts and appreciate its importance (SIGMAA QL, 2004), is directly linked to matters of practical relevance to students such as wage increases and employment likelihood (Rivera-Batiz 1992; Eide and Grogger 1995; Levy et al. 1995). As it turns out, conveying this concept of a numbers-saturated world to college students who have traditionally avoided mathematics is a nontrivial challenge. This is where *Case Studies for Quantitative Reasoning* shines.

The text’s genesis is in 2004, when co-authors Shannon Dingman and Bernard Madison (2010) of the University of Arkansas began work to create a “QL-friendly” course for students (p. 2). The goal of their course was not to simply throw the same algebra at students that has (perhaps) haunted them over time, but rather to prepare them for “quantitative situations they encounter in everyday life” (p. 3). Notwithstanding this simple goal, the fact that quantitative situations abound does not imply that appropriate textbooks are also plentiful. Indeed, an examination of any major publisher’s website signals that below the college algebra and precalculus levels, most textbooks for introductory college courses are filled with topics in finite mathematics or math appreciation. While potentially engaging, these texts still miss the mark in demonstrating how math is useful in day-to-day living. Indeed, in describing the text, Dingman and Madison (2010) modestly note: “the availability of high-quality curricular materials that engage undergraduate students to reason in real-world settings is rather limited” (p. 7). So they created their own, adding to a meager (though growing) list of textbooks for QL (e.g., Sevilla and Somers 2012; Crauder et. al 2014; Gaze 2014; Bolker and Mast 2015). This review will describe the text’s structure and give recommendations for how one might use it in a course.

Book Overview

At 215 pages, the text itself is compact and straightforward. Its online resources include an instructor’s manual, sample syllabi, as well as a mapping to quantitative reasoning standards developed by the book’s authors. In all, the text contains 24 media articles that serve as case studies highlighting relevant mathematical concepts. The studies are not disjoint, but rather fall into six overarching chapters organized by math content. The sections are entitled: Using

Numbers and Quantities; Percent and Percent Change; Measurement and Indices; Linear and Exponential Growth; Graphical Interpretation and Production; and Counting, Probability, Odds, and Risk. The authors state that college algebra is a course prerequisite when the text is used at the University of Arkansas; however, this reviewer finds that malleable. As discussed later, this reviewer used the text as a supplement within a college algebra course.

Each chapter (aside from one on measurement and indices) begins with a discussion of relevant mathematical concepts. The exposition is concise and sufficient for the topics students will encounter in the ensuing articles. In a course with regular meetings, an instructor could easily give a brief lecture in line with the content. Each content section includes targeted exercises so that students (and instructor) can ensure understanding before moving on to the articles, where their understanding is necessary for a substantial analysis.

With that said, the meat of the book is in its articles (case studies). As promised by the authors, the content within each is likely to engage students. Bulleted below is a sampling of topics that either the articles or exercises delve into; an eager instructor or student could easily turn many of these into a substantial discussion or project:

- The federal budget (and deficit)
- Defense spending
- Statistics in sports
- Tax rates
- Incarceration rates among dropouts
- Unemployment rates
- Hospital rankings and health care costs
- The finance behind fuel efficiency
- Credit cards
- Body mass index
- False positives and disease screening

Each study includes a “warm-up” section with exercises (similar to those mentioned above) that target concepts germane to the article itself; in addition, each also contains well-written questions about the article. The post-study exercises make it clear that the authors understand QL and how to assess it. Some of the questions have a correct mathematical answer, but others require students to provide a conjecture or give examples of a phenomenon in their own lives; no

matter the type, students are asked to provide a well-reasoned explanation in proper mathematical language. In light of this distinction in question type, it is understandable that the book's accompanying solutions manual is only a guide. This type of question will likely surprise students who have had a traditional experience in high-school (or college) mathematics courses; to their potential chagrin, students discover there may be no correct answer.

Potential Uses

A wonderful aspect of the text is its wide range of potential uses. A few are described below.

As a Course Supplement

This reviewer used the text as a supplement within an online college algebra course. As one can determine from the book's table of contents, many of the topics are relevant to an algebra or precalculus course. For the reviewer's course, the contents included the chapters on percent change, linear versus exponential growth, as well as graphical interpretation. The first, on percent change, was used in the first weeks of the course to ensure students would have the prerequisite background for later work with exponential functions. Students read Case Study 1.2, entitled "Numbed by the Numbers & Three Bad Numbers"; it consists of two articles riddled with percentages and other statistics, many of which the authors of the articles use to sway an unaware reader. There are six post-study exercises that highlight this lurking danger; the questions require rereading of the articles and critical thinking. Students in the online course completed an online version of the exercises, and they participated in a discussion forum with questions similar to those at the end of the study. In hindsight, it is easy to imagine a similar scenario playing out in a face-to-face course – the discussion would simply be in groups or as a class.

From an instructional standpoint, all of the case study inclusions were well-timed and informative. The exercises preceding each study ensured students understood the background material and could participate meaningfully in the discussions; students who *did not* succeed with the background information still participated, but it was clear that their insight into the articles was pedestrian and strained. As an example, with Case Study 1.2, students who struggled with the concept of how changes in a quotient's numerator differ from those in a denominator also struggled with a discussion question on how the unemployment rate changes. This struggle manifested itself in their simplistic and incorrect answers on the discussion forum. Despite these small issues, it was clear from evaluations that students loved the departures from what they viewed as traditional math within college algebra.

With the above discussion in mind, it is clear that the text could supplement a number of courses – not just an online one. An instructor in college algebra, precalculus, statistics, and even non-mathematics courses could utilize specific studies when relevant to the discussion. For example, it is easy to envision the chapter on odds and risk being used as a springboard for discussion in a statistics or “math for the liberal arts” course.

For a Standalone Course

For anyone considering the text for a quantitative reasoning course, the book’s accompanying website includes sample syllabi on how one might do so. Having read and used the text, the reviewer believes it could be used in a discussion-based face-to-face course, and even be used for an online course (for someone with experience in the digital realm). In accomplishing the former task, ideally one would have projects and presentations on topics that students find interesting from the text. Lecture would be minimal and cover only the necessary content for the articles; afterwards, one would have discussions based on the exercises found at the end of each study. In addition, in light of the text’s focus on consumer literacy, it would be nice to have accompanying readings from other sources within the course. Books might include the famous *How to Lie with Statistics* (Huff 1954), or *Damned Lies and Statistics* (Best 2001), or even *Freakonomics* (Levitt and Dubner 2005). These, of course, are simply suggestions; for the best insight, one should take a look at the sample syllabi on the text’s site.

Conclusion

For those interested in quantitative literacy at any level, this concise and well-written text is a gem. Its all-inclusive nature allows one to ensure that students get the math they actually need, and the discussion questions included are the ideal embodiment of how one creates higher-order thinking tasks that promote quantitative reasoning. Even if one does not plan to teach a standalone quantitative reasoning course, the case studies still give ideas for how one might incorporate fresh and engaging topics into class. Indeed, the content is wide-ranging enough so that an instructor of nearly any course might find a nugget to include from the text. As the book ages, one potential issue is that the articles may need to be updated in order to keep the topics relevant and students’ interested; however, as the text is already in its third edition, it appears that the authors are already addressing that concern. Steen (2001, p. 1) notes we live in a world “awash with numbers,” and this text makes that assertion clear; fortunately though, it also serves as a resource that – with proper guidance – will help keep students afloat.

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