

The Story and Content

This Statistical Literacy textbook is focuses on the statistical needs of consumers: students in non-quantitative majors. Majors such as journalism and political science as well as future citizens in English, Art, Film, etc. Today's students are inundated with social statistics – often used as evidence for policy changes. Confounding and assembly (how things are defined, grouped and presented) are the most important topics in analyzing and evaluating social statistics. These topics are all but absent in Stat 101. Most statistics textbooks do not include confounding in their index. This textbook is the doorway to a new discipline: one focused on studies and summary data where the ultimate goal is to read and interpret statistics in the everyday media.

- This textbook is different: minimal Algebra and less than a 30% overlap with the content in Stat 101. Students learn to distinguish association from causation, experiments from observational studies and hard science from soft science. Heavy emphasis on using ordinary English to describe and compare rates and percentages as presented in tables and graphs. Students learn that "the percentage of men who are runners" is different from "the percentage of men among runners."
- This textbook is mathematically rigorous. Students work multivariate problems that convert a crude association (a mixed fruit comparison) of ratios into an adjusted comparison by taking into account (controlling for) the influence of a confounder. And they do this without using a computer by using weighted averages. They find that as much as 40% of the black-white income gap can be explained by the difference in family structure. Students see how controlling for a confounder can influence statistical significance: something not included in Stat 101 textbooks.
- This textbook is designed for the 21st century. It focuses on social statistics that involve disparities. Although disparities are often used as evidence of systemic discrimination, this textbook argues that statistical educators have no expertise in such judgments. But, statistical educators do have expertise in showing how statistical associations can be influenced by other factors: confounding, assembly, randomness and error or bias. This approach seems satisfactory with social justice warriors, equal justice warriors and those in-between.

What are the steps involved in selling this textbook?

- Phase 1: Create and student-test the textbook, exercises and tests. [Done]
- Phase 2: Get this course adopted by a major public university as satisfying a math requirement in their general education curriculum. [Done at UNM]
- Phase 3. Get teachers to buy and study this radically-different textbook. Get teachers to offer this course as a special topics course. Get math-stat departments to get this course approved as satisfying a mathematics requirement in their general education curriculum.

Milo Schield

Does your proposed project provide opportunities to improve diversity and representation in your discipline? Will you be able to include perspectives from historically marginalized groups or voices? How does your proposed product advance inclusion, diversity, and belonging within your discipline?

- Social statistics – by their very nature – focus on diversity. This textbook is based on evaluating social statistics. Social statistics include the 1860 census on slaves and slave-owning households, and the change in family structure by race since the 1940s along with the gender and racial composition of those arrested, in prison, or killed by the police.
- Social statistics summarize economic diversity: the distribution of income and assets by race, gender and family structure. By separating disparity from discrimination and showing how the former isn't sufficient to justify the latter, this textbook may become a standard for decades to come.
- Teachers are free to use their own social statistics along with this textbook. These statistics may focus on the survivors of the Titanic, birth and death certificates for a given time and place, etc.

What material is available for review?

- This textbook is complete: a 350 page (115,000 word) Word document in a 6x9 format. It comes with a table of contents, a glossary (23 pages, 300+ entries), an index (6 pages, 400+ entries), a table of figures (5 pages, 220+ entries) and a table of tables (3 pages, 120+ entries). Most figures and tables are available separately in 600 dpi jpg. Most of the data in tables and graphs is based on government sources, so permissions are minimized.
- Along with this textbook are over 800 multiple-choice problems and a dozen manually-graded one-line writing questions. Both have been students tested and are organized by topic within chapter.
- This textbook was initially financed by a major grant from the W. M. Keck Foundation in 2001. This textbook is in its 8th self-published edition having been taught by over a dozen teachers to over a thousand students since then.
- Wiley-UK signed a contract to print this textbook and provide the associated course management system. But they reversed that decision saying their minimum criteria for providing course management software had increased. So, so the choice was either to sign a new contract without the course management software or to be released. The latter was the only viable alternative.

The Market

Which higher education course(s) would be the most likely targets for your project?

- Likely target: *Alternative to the traditional Stat 101 course. Stat 101 is a required course for almost half of all college graduates. This course targets the other half of college students most of whom are in non-quantitative majors.*
- Why? #1: *The traditional inference course is designed for data producers. Many – if not most – students taking statistics will be statistics consumers. #2 GAISE 2016 update calls for more emphasis on multivariate data and confounding. There isn't much time/space in the introductory course to add any new topics.*

Is it intended as a primary or supplemental resource?

- *Primary.*

What is the proposed format of the product (print book, eBook, digital learning resource)?

- *Print (75%) and eBook (25%) if priced below \$100.*

How many schools would be likely to use this product in their courses each year?

- *Adoption may be slow but the market is huge! Eventually: all colleges. Stat 101 hasn't changed substantially since the 1950s. The Univ. of New Mexico (ABQ) has adopted Statistical Literacy (Math 1300, 200 copies/year). Math 1300 now satisfies a mathematics requirement in the New Mexico General Education curriculum. Once this textbook is published other schools will follow.*
- *Initially sales to teachers will outpace sales to students. After reading this new textbook, teachers may include parts in their Stat 101 classes, then teach it as a topics course, and only then move to offering it as a regular catalog course.*

What trends (changes in enrollments, course content, approaches to course content or course delivery, research, or new pedagogies) are likely to affect this textbook?

- *Change in Students: An increasing fraction of enrollments are students with weak Math skills. This textbook is directed to students in non-quantitative majors. It avoids the use of algebra. It uses ordinary English.*
- *Emphasis on critical thinking: There is a constant call to focus on critical thinking. Many textbooks promise this, but few deliver. This textbook focuses strongly on critical thinking about statistics as evidence in arguments.*

Are there any trends likely to affect the marketing of the project?

- *There is a growing focus on statistical disparities as evidence of discrimination or systemic racism. Evaluating these disparities creates a need for a course that deals with these topics in a professional non-ideological manner.*

Are instructors teaching this course likely to use digital delivery and assessment? What specific materials would they likely use?

- *Most will use face-to-face delivery with online exercises, tests and assessments. They need an online course-management system with a gradebook. However, this course is being taught in all three modes: face-to-face, hybrid and remote.*

The Competition

Please provide an analysis of the competition, including strengths and weaknesses, and a description of features that distinguish your product from the competition.

- *Competition: The good news is there is no competition. This textbook has the potential to disrupt the teaching of introductory statistics. Students like the course. The two big problems are getting this new course approved to satisfy a math-stat requirement in general education, and teacher training.*
- *Distinguishing features: A holistic approach covering all the influences on social statistics. As a result, a stronger focus on confounding and assembly than on randomness and statistical significance. With big data, all associations are likely to be statistically-significant. A stronger focus on effect size and on adjusting crude associations based on large observational studies than on random sampling, clinical trials, statistical tests and statistical significance.*

What would make your product stand out from these competitors? Why would someone adopt your product instead of any of the existing products on the market?

- *This textbook is different: minimal algebra and has less than a 30% overlap with any traditional Stat101 textbook. But it is mathematically rigorous without requiring a computer. Students work problems involving multivariate analysis using weighted averages that take into account (control for) the influence of a measured confounder.*

Why would someone adopt this textbook?

- *Today's students need a different statistics course. Most of today's social arguments involve social statistics obtained from observational studies. These social statistics are used to argue about their causes. The traditional statistics course merely says "Association is not causation" and moves on. This course argues that associations are our best way to identify causation and gives help in evaluating how strongly an association supports causation.*

Vita and Qualifications

Schild has very strong credentials.

- *Academic credentials: BS Physics and Mathematics at Iowa State Univ. MS in Physics at the University of Illinois – Urbana. PhD in Space Physics (Theoretical) at Rice University*
- *Teaching credentials: 35 years college teaching in total. 10 years teaching critical thinking to students who failed the critical thinking test. 30 years teaching traditional introductory statistical inference. Five years teaching statistical modelling. 20 years of teaching statistical literacy*
- *Awards: Principal investigator on a \$500,000 grant from the W. M. Keck Foundation in 2001 to “Develop Statistical Literacy as an Interdisciplinary Curriculum in the Liberal Arts.”*
- *Prior publications: Over 70 statistical literacy papers that have received over 1,200 citations according to Google scholar. All papers on ResearchGate and available at www.StatLit.org/Schild-Pubs.htm*
- *Honors: Elected a Fellow of the American Statistical Association (ASA). Made an Elected Member of the International Statistical Institute (ISI).*
- *International presentations: 39 talks in 18 countries on six continents.*
- *US presentations on Statistical Literacy: Given over 100 talks. Organized 17 sessions at US and international statistical conferences.*
- *Conducted invited workshops and discussion groups for statisticians: IASE (Berlin), USCOTS (Japan), ECOTS (2019, 2021) and ASA JSM (2020, 2021).*
- *Website: Editor and owner of www.StatLit.org. This is the largest website dedicated entirely to statistical literacy with over 300,000 visits and over 400,000 downloads per year.*
- *Endorsements: In “More Damned Lies and Statistics”, Joel Best noted, “a small educational movement advocating statistical literacy is emerging. Dr. Milo Schield, director of the W. M. Keck Statistical Literacy project at Augsburg College in Minneapolis, is the movement’s leading voice.”*
- *Current positions: President of the National Numeracy Network (NNN) US representative of the International Statistical Literacy Project (ISLP). Consultant: University of New Mexico, Mathematics & Statistics Dept. Professor Emeritus, Augsburg University.*
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STUDENT COMMENTS (Fall 2021 at UNM) in all four sections:

"This class is very challenging yet, fun for me and I am doing my very best... I feel confident in this course and just appreciate all of what you instructors have done. I didn't do well in my statistics course last semester, so to be able to feel like I am understanding and am engaged in this course as an option, is very rewarding."

WHAT DO YOU LIKE ABOUT THIS COURSE? Anonymous Survey: Fall Semester 12/5/2021

Note: Odyssey is the name of the writing forum.

Section 1: 11 responses. 100% took high school AP. Grades: 64% pass; 18% C- or D; 18% No answer.

1. I do like how this class recognizes that a lot of the math that a person is taught will have no bearing on the rest of their life. Critical thinking is more important overall than memorization of equations.
2. Odyssey & thinking about what causes biases in statistics
3. I like new stories the best.
4. What I like best about the Statistical Literacy is emphasis on critical thinking and its connection to a logistic [logical?] outcome.
5. I like reading tables and graphs! I think it's also cool that we can apply this to statistics we see every day.
6. I highly enjoy the new stories and emphasis on critical thinking because it allows students to have a different approach to statistic related life occurrences.
7. The textbook is my favorite it is a really good resource correlates amazing with the class.
8. I like the critical thinking aspect of the class.
9. Critical thinking. The textbooks templates. Examples in textbooks
10. I liked the Odyssey challenges most of all, probably.
11. Odyssey is nice as well as the news stories, but for the textbook at time I feel like it's difficult to read a lot of times

Section 2: 16 responses. 88% took AP in high school. Grades: 69% pass; 5% C- or D; 25% Don't know.

1. Topics were interesting, and critical and counter intuitive thinking were needed, which I enjoyed.
2. I liked reading the tables and graphs because it gave me an understanding of what they meant and they made me aware that not all information given is the same.
3. I enjoy how we can relate the things we learn in class to real life scenarios and learn about the importance of learning about statistics.
4. I liked that the things we learned were applicable to life - I caught myself several times using information I learned from this class in daily conversation. I also liked how straightforward the regular assignments were.
5. we can work with other people
6. I like the critical thinking aspect of the course and understanding the roles of confounders and bias. I also think rob was a great and very laid back professor which made it more comfortable to ask questions.
7. *I like the critical thinking. I feel like I haven't been able to have some critical thinking in my other classes.*

Milo Schield

8. I like when we look at models or real life problems that we could break down and figure out if the statistics are telling the truth.
9. I enjoy the critical thinking aspect of this course. The most helpful thing to me was reviewing and working out problems in class. I like the Odyssey exercises too because it gives you a chance to see peers' thought processes.
10. I like reading tables and graphs, as well as bringing in today's current information into the course to help us understand how we can use this course in real life
11. I like reading tables and graphs!! i also like the actual homework when I remember to do it
12. I liked the quizzes, because they gave me practice over the materials.
13. i liked the critical thinking of class along with the smaller amount of a math going on.
14. I don't really like anything in this course.
15. I like the Statistical Literacy book, I think it is very helpful. I also like having group discussions in class, playing with blocks, doing 2x2 tables, and professor Giebitz lectures.
16. I like reading tables and graphs and I like questions that require critical thinking because I feel like these things are beneficial to know in the real world outside of school.

Section 3: 18 responses. 67% took AP in high school. Grades: 56% pass; 39% C- or D; 6% Don't know.

1. News stories, reading tables, and critical thinking.
2. I like Dr. Schield and the news stories. I like his enthusiasm and the hope he has for his students, even if they aren't doing well in the class.
3. I enjoyed the critical thinking and logic that this course seemed to base itself around.
4. I really enjoy learning how to read graphs and things like survey results constructively. This is the first time I feel like I'd actually use a math class outside of the classroom regularly.
5. What I like best is the pacing of the class, as well as the fact that the class is taught by the author. The assignments are easy to understand, and are easy to find.
6. page 162 and 173 helped me the most. [Templates for percent and percentage grammar]
7. I really Like Milo Schield. He makes the class really fun and interesting. I have to say that I've despised every other math class I've ever taken but this one is actually enjoyable. It also seems more useful than any math course I've ever taken.
8. I like the critical thinking aspects about it.
9. I really like the way Doctor Schield teaches and gets us all involved. I like Odyssey too, the textbook is super helpful when completing homework and I like how it uses statistics that are based around real-life.
10. I enjoyed critical thinking and the news stories. Both provide beneficial knowledge I will take with me into my everyday life.
11. I think Odyssey is a great way for us to think critically about certain topics. I also think the textbook is pretty well made and easy to understand and read.
12. The critical thinking. I don't have many chances in other classes to be a critical thinker.
13. The first topics seemed very useful for everyday life.
14. *I like the content and critical thinking aspect of the class. As someone who had to drop the regular stats class I was very happy to have this class as an option. I feel like the content has the overall goal of helping me with critical thinking. There are many times now where I am looking out for parts and whole in people's statements and critically thinking about what people are saying more often. So I would say that the content is also more applicable for life goals. I would have to say that the regular stats class is very not useful to me because the content will not matter later in my life. Taking that class back in the spring I just was so confounded on why I was needing that class for general ed. But like I said I really appreciate having this class as an option.*

Statistical Literacy Textbook Proposal

Milo Schield

I would also like to say I really appreciate all the work you've put into the course. Every class period I see just how tired you are. It sometimes looks like you have slept in days. So the fact you are putting in this much work makes me appreciate the course even more. I thank you for that a lot.

15. Reading tables is nice.
16. The in class critical thinking.
17. I liked the Odysseys, it was a good way to practically apply the ideas we were learning in class. I also liked the practice assignments, and especially the topics going over words choice and manipulation in the media.
18. I enjoyed the critical thinking aspect and the percent grammar section in chapter 4 but I'm more of an equations type of person so this course has been challenging personally.

Section 4: 17 responses. 53% took high school AP. Grade: 65% passing; 12% C- or D; 6% F; 18% Other

1. The set up and idea behind the class as a whole are my favorite part, tackling statistics from a different angle that is much more engaging for those who find math subjects to be typically challenging is a brand new approach and one that I think would be beneficial for a broader group of students. Attempting to explain the workings behind statistics has personally allowed me to understand the material much better than I had previously
2. I like how there is very little calculation and I can defend my answers.
3. I like the tables and graphs because I am a visual learner and I like my answers to odyssey.
4. I liked odyssey a lot once I got the hang of it.
5. I liked looking at news stories and learning to read them more critically. I also liked that we covered graphs quite a bit.
6. I liked statlit [statistical literacy]
7. I really like how we can always relate the topics back to real life, and how we can actually apply these concepts to real life ideas and situations.
8. critical thinking.
9. I think the Odyssey was an interesting way to boost the grades of students, and the teaching incorporated the materials in the textbook which I found to be very useful. This course has taught me how to improve my critical thinking overall.
10. I liked how much critical thinking was used throughout the course. The Odyssey discussion post were also very insightful. Overall, it an excellent course that doesn't contain any overly complex math, but still includes the calculating aspect without it being too difficult.
11. The amount of attempts per each quiz is helpful.
12. I enjoy the news stories. I like that this course applies our math lessons to real world situations.
13. I think the textbook is very comprehensive.
14. *This course is an answer to my prayers, I am a music major and horrible at math so fulfilling my math requirement has been hard. This is the first math class I actually liked. I loved the format and the material is about things I can apply to everyday life. The textbook is fantastic and helped me a lot accompanied by the instruction. I would recommend this class for anyone.*
15. I liked the quizzes the most and it really helped when the professor brought in practice sheets so we could follow along with her.
16. I enjoy the critical thinking that comes with the course. My instructor was very willing to work with the class and converse through disagreements regarding statistical analysis in class, coming to a common understanding effectively.
17. I enjoy the way Tamra teaches, the book is extremely helpful and the topics were interesting.