

V1 2022 Schield ASA 1

Statistical Literacy: UNM First Year Results

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US Coordinator, International Statistical Literacy Project

August 10, 2022
Slides and paper:
www.StatLit.org/pdf/2022-Schild-ASA-Slides.pdf
www.StatLit.org/pdf/2022-Schild-ASA.pdf

V1 2022 Schield ASA 2

2021-22: UNM Offers Math 1300 Statistical Literacy

This confounder-based course is different:

- designed for students in non-quantitative majors
- designed as an alternative to Stat 101.
- satisfies math requirement in GenEd curriculum.
- does not use any computer software.
- has less than a 30% overlap with Stat 101.

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Math 1300: Statistical Literacy

STATISTICS STUDIES VARIATION
Two kinds of variation

SYSTEMATIC
Confounding
[Studies, Ratios
Take into account]
Assembly, Bias
Statistical Literacy

RANDOM
Margin of error
Confidence intervals
Test of hypothesis
Statistical significance
Statistical Inference

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Statistics: The Four Essentials	
1	Statistics are numbers <i>in context</i>
2	Statistics are <i>socially constructed</i>
3	Statistics can be <i>influenced</i>
4	<i>With statistics, "Take Care"!!!</i>

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Statistical Literacy: Social Statistics vs. Numbers

Statistics are numbers in context (in reality)
Statistics can be influenced by reality:

- In arithmetic, 1 plus 1 is always 2.

1 + 1 <= 2

Bunny math: 1 + 1 >= 2

Ice cube math

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"Statistics are Socially Constructed"

Joel Best, author of "*Lies, Damned Lies and Statistics*" identified this fact as *the most important, the most fundamental, aspect of all reality-based statistics.*

Statistics, just like words, are created by people: people with motives, values and goals.

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Statistics can Be Influenced




Q. Best advice when dealing with statistics?
 A. "Take CARE". Statistics can be influenced.

All influences are grouped into four categories:
C: Confounding: Confused by related factors
A: Assembly: how things are defined, counted, etc.
R: Randomness
E: Error (including bias)

V1 2022 Schield ASA

Admonition: "Take CARE"



Students like "CARE". It gives them a structure.

When asked to rank what idea they considered the most valuable, students chose "Take CARE".

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Today's student need to study Statistics

Disparities in

- Education, suspensions and graduation
- Policing, crime, sentencing and prison
- Wages, income, assets, loans and wealth
- Health, health care, homicides and deaths

Disparities by
 gender, race, ethnicity, religion, politics, age, etc.

All of these rely on statistics: social statistics.

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Confounding

Association: *People who read home and fashion magazines are more likely to get pregnant than people who read car and sport magazines.*

We know that pregnancy isn't caused by magazines.
 We know that only women can get pregnant.

We quickly recognize that women are more likely to read home and fashion magazines than men.

QED. This association is confounded by gender.

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Where is the Math? Confounding: Covid Deaths

Covid vaccinated cases are MORE likely to die than unvaccinated cases.

Covid Death Rates Per Case		
	Crude Rate	# Cases
Unvaccinated	0.17%	151,052
Vaccinated	0.41%	117,114

41/17 = 2.4 UK NHS 2021

This result is unexpected. Doesn't make sense.

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Covid Death Rates by Age

Covid Death Rates Per Case			Death Rates by Age	
	Crude Rate	# Cases	<50	50+
Unvaccinated	0.17%	151,052	0.03%	5.96%
Vaccinated	0.41%	117,114	0.02%	1.68%

41/17 = 2.4 UK NHS 2021

Who are LESS likely to die?
 Under 50: Vaccinated. 50+? Vaccinated

Confounder: "It's the mix!"
 Elderly: 23% of vaccinated, 2% of unvaccinated

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Covid Death Rates Simpson's Paradox


Paradox: Two group comparison has opposite direction from that in each of the sub-groups.
Impossible with counts. Possible with ratios.

Simpson's paradox: the elephant in the room for the social sciences.
What causes it? It's the "mix"!
A crude comparison: a "mixed fruit" compare!

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Confounding is the elephant in observational statistics

Teachers know it.
Not in intro. statistics or research methods.
It should be taught in an introductory course.
There isn't time in traditional statistics.



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Confounding: Taking into Account

"Taking into account" the influence of a related factor means converting a mixed-fruit comparison (apples and oranges) into a same fruit comparison (apples and apples).

Taking into account can reverse the direction of a comparison: Simpson's paradox.

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University of New Mexico is offering a new course!

Taught 7 sections in 2021-22




Statistical Literacy 

MATH 1300 (3)
Participants will study the social statistics encountered by consumers. Investigate the story behind the statistics. Study the influences on social statistics. Study the techniques used to control these influences. Strong focus on confounding.
Meets New Mexico General Education Curriculum Area 2: Mathematics and Statistics.

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Math1300: Statistical Literacy

Less than 30% overlap with traditional statistics



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Math1300: Statistical Literacy Four Parts (% of grade)

25% Odyssey writing forum: 1-2 cases / week.
20% Exercises: 15-20 multi-choice (2 try) / week.
Write 2-4 one-line statements: Manual grade.
Compare counts; describe ratios (part/whole)
5%: Attendance:
50%: Quizzes (two 12%@) and Final (26%)
Textbook: Schield 2021 and 2021B.

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1. Odyssey Writing Forum

Each case is a challenge. No research required.
Odyssey forum is different:

1. Everyone is anonymous (no avatar)
2. No free-riders. Can't see others till after you post
3. Everyone grades everyone else.
4. Odyssey computes each student's power.

More info: www.statlit.org/pdf/2014-Schild-ICOTS.pdf

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2. Exercises

Multiple choice: field tested (1,000+ students).
Immediate feedback on right-wrong.
Helpful hints/comments on why it is wrong.
Closely aligned to the textbook.

One-line essay:
Compare two counts: difference, ratio, % more.
Describe part-whole ratios from tables & graphs
Use Percent and Percentage grammar.

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3. Textbook: Eight Chapters

1. The story behind the statistics
2. Comparisons and CARE solutions
3. Understanding Measurements
4. *Describing ratios: Percent & Percentage*
5. *Describing ratios: Rate, Chance and Ratio*
6. *Comparing ratios: Named ratios and Likely*
7. Interpreting confusing ratios
8. Randomness

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4. Student Evaluations
www.statlit.org/UNM.htm

“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.”

“I enjoyed critical thinking and the news stories. Both provide beneficial knowledge I will take with me into my everyday life.”

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“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; the material is about things I can apply to everyday life.

The textbook is fantastic and helped me a lot...
I would recommend this class for anyone.”

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Conclusion

Statistical Literacy involves statistics, writing and critical thinking. This course is very different from a typical mathematics course.

Statistical Literacy must be tailored to the students involved. First year-students are very different from Seniors or Honors students.

Students see value in taking Math1300. To help their students think critically about statistics, other colleges should offer Statistical Literacy.

Statistical Literacy: UNM First Year Results

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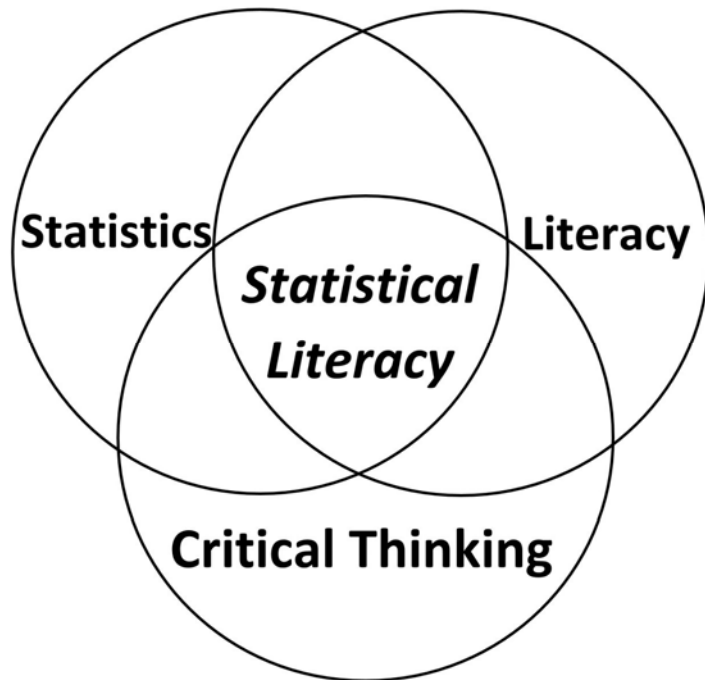
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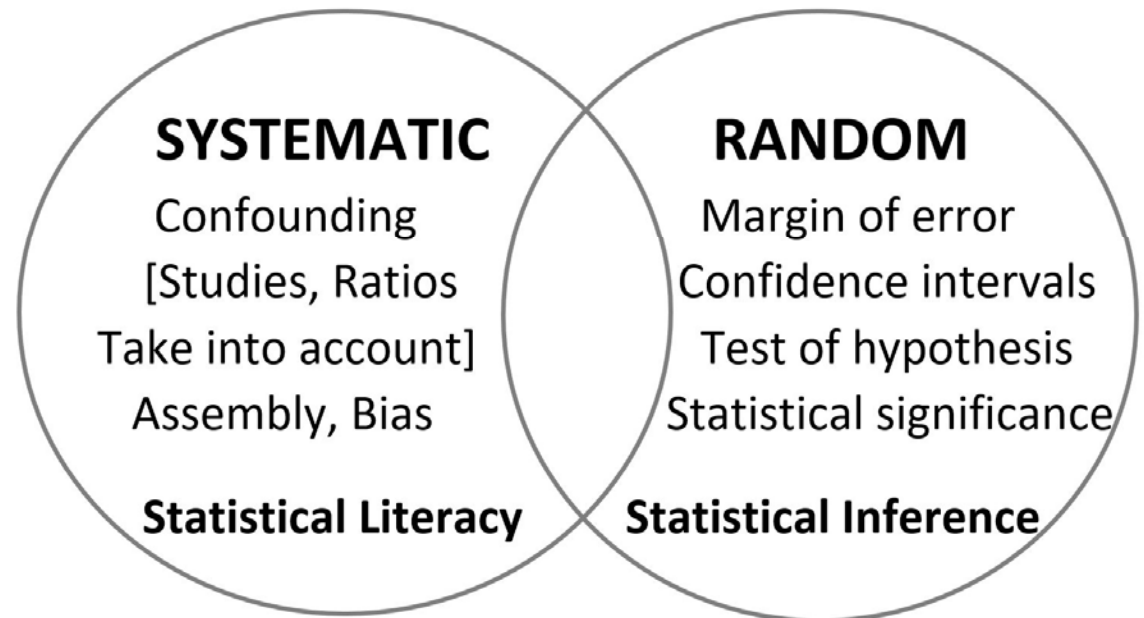
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Math 1300: Statistical Literacy



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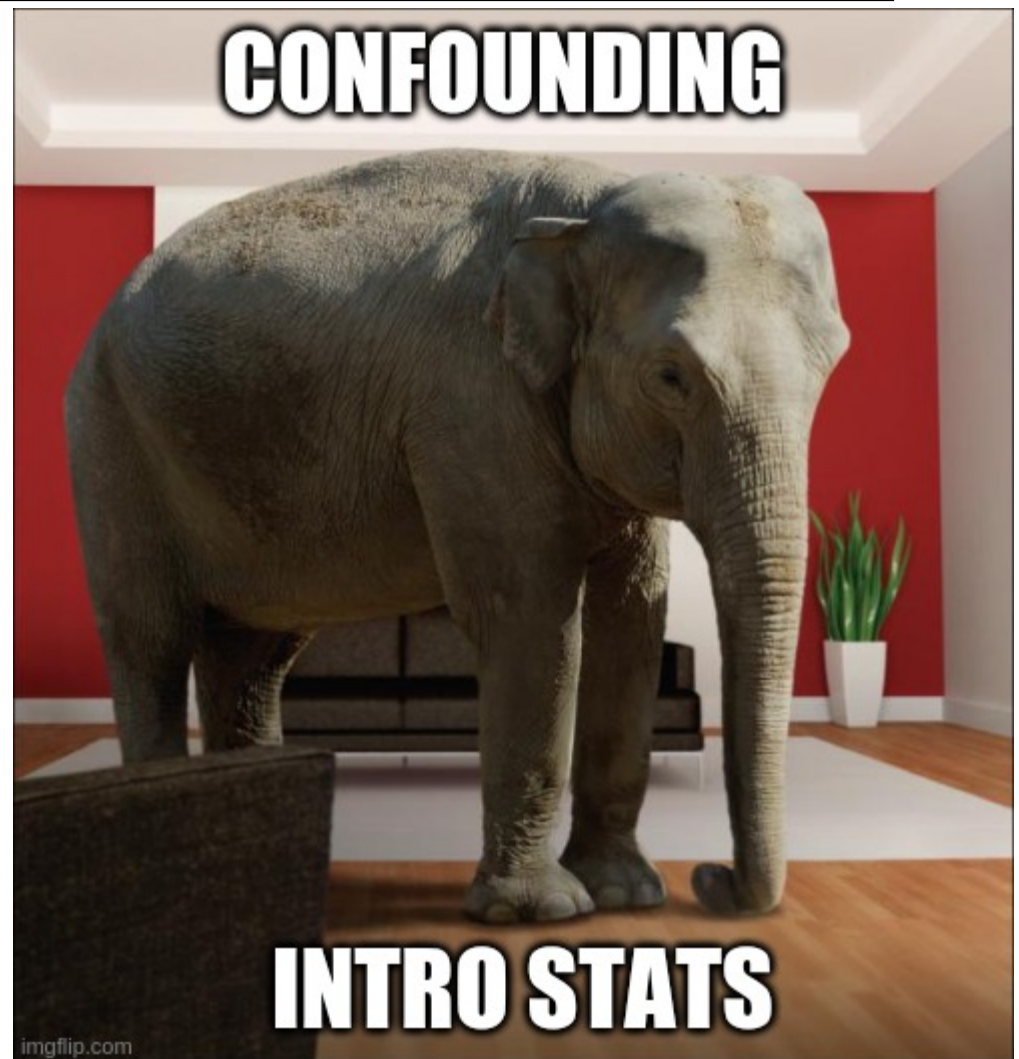
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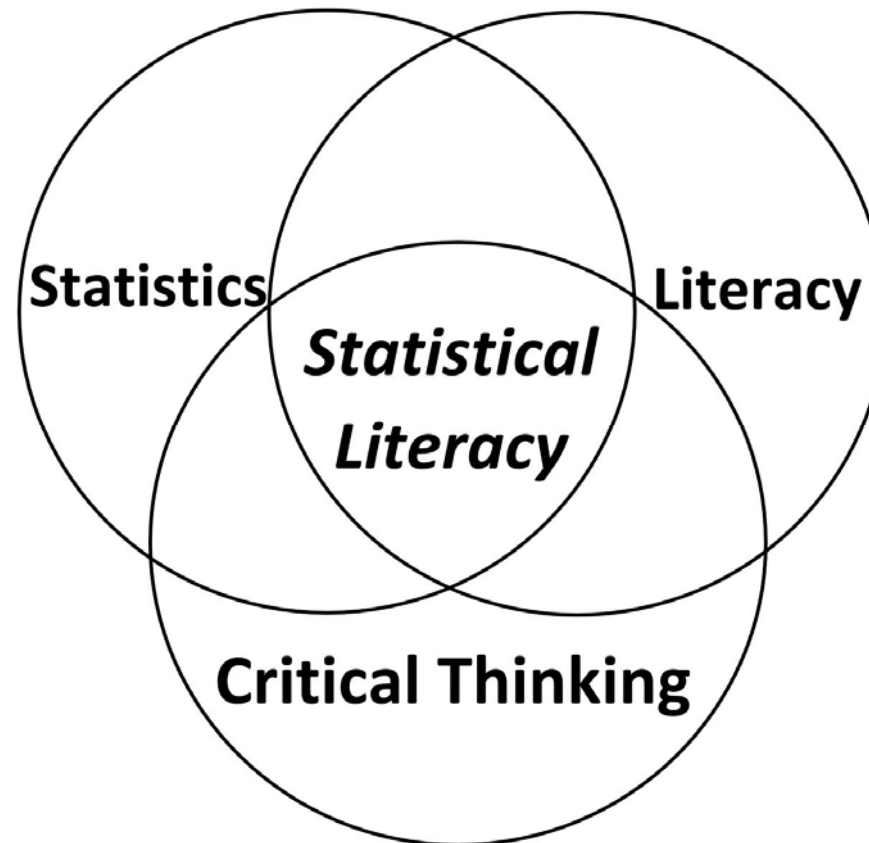
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