

Abstract of Talk at RoSE 2025
Statistical Literacy Provides Research Opportunities
Milo Schield <miloschield.com>

CONFERENCE: <https://www.rose-network.org/events/rose-2025>

July 31, 2025.

SESSION: 30-45 min collaborative idea development session

ABSTRACT: Confounder-based statistical literacy is a new and different subject. As a topic, it embraces the 2016 ASA GAISE guidelines to emphasize multivariable thinking and confounding. As a course, it is designed for students in non-quantitative majors. It doesn't use or require algebra or computers. It has less than a 30% overlap with classical introductory statistics. The course has a heavy focus on using English to describe and compare ratios. It uses Schield's Kendall-Hunt textbook: *Statistical Literacy: Critical Thinking about Everyday Statistics*. As students increase their use of AI, their need for critical thinking increases. Starting this fall, this intellectual foundations course is being required by all statistics majors at the University of New Mexico, and by all incoming students at New College of Florida. Students value this course: 50% agree or strongly agree that it should be required by all students for graduation (40% neutral). This textbook and the aforementioned topics and claims are based on 100+ research papers that have received over 1,400 Google-scholar citations. This session presents over a dozen research opportunities associated with these claims, topics, textbook and course.

This course:

* Emphasizes confounding in observational studies. Students learn what it means to take something into account quantitatively by working problems using weighted averages. Students can see Simpson's paradox using a simple graphical technique. Peter Holmes (RIP; organizer of the first ICOTS in Sheffield) said that seeing this graph was the first time he understood what caused Simpson's paradox.

* Emphasizes that how statistics are assembled (defined, counted, measured, summarized and presented) can influence the numerical results.

* Introduces important distinctions: hard science vs soft; crude statistics vs. adjusted, likely vs. frequent, and attributable to vs. due to, because of, or caused by. Introduces new topics: the Cornfield conditions (necessary conditions for a binary confounder to nullify or reverse a two-group association), journalistic significance, Scanlan's paradox, and the diabolical denominator. Shows how a statistically-significant comparison can become statistically-insignificant after controlling for a measured confounder (and vice versa).

* Makes statistically-controversial claims: Uses Bayes' rule to argue that if the research hypothesis is more likely than not to be true, then a statistically-significant result gives at least a 95% chance the Null is false. Proposes an exponential distribution with a mean $RR = 2$ as a useful model for the distribution of unknown confounders. Uses this distribution to argue that an effect size of at least 4 is needed for a crude two-group comparison to be confounder-significant (less than 1 chance in 20 of being nullified or reversed) in a cross-sectional study.

* Makes socially-controversial claims such as those involving the male-female income gap and the black-white family income gap. Statistical educators are argued to have no expertise in determining whether a disparity is due to systemic discrimination, but they have considerable expertise in investigating how an observationally-based association can be influenced. In both aforementioned cases, the income disparity decreases after controlling for plausible confounders. Cases are needed in which the crude association increases to avoid implying that the crude association is always bigger than an adjusted comparison.

Related publications: www.StatLit.org/Schield-Pubs.htm

Proposed pre-conference reading list:

Schield, M. (2024). GAISE 2024 Proposal. ECOTS. <http://www.statlit.org/pdf/2024-Schield-ECOTS.pdf>

Schield, M. (2024). Statistical Literacy: A New Course. ISLP. <http://www.statlit.org/pdf/2024-Schield-ISLP.pdf>

Schield, M. (2018). Confounding and Cornfield: Back to the Future. www.statlit.org/pdf/2018-Schield-ICOTS.pdf

Textbook at: <https://he.kendallhunt.com/product/statistical-literacy-2023-critical-thinking-about-everyday-statistics>