

Overview: The goal of this grant is to train 800 statistical educators at US four-year colleges to teach a statistics course (sometimes described as a statistical literacy course) specifically designed for students in the social sciences and the humanities, a course that focuses more at least as much on confounding as on chance, a course that focuses at least as much on ordinary English as on algebraic formulas, a course that social science and humanities majors value and recommend that it be required of all students for graduation.

The biggest problem in achieving this goal is teacher training. Statistics is most easily taught by deduction and calculation. Retraining statistics teachers to teach statistics as a liberal art is almost as difficult as retraining philosophy faculty to teach philosophy as a social science.

This project is ready for rapid dissemination via online training. The W. M. Keck Foundation supported Phase 1 with a \$500K grant. The Principle Investigator developed a student-tested textbook and exercises (used by over a thousand students), a respected website (www.StatLit.org with 180,000 visits during 2013) and faculty training materials (used by faculty at three colleges).

This proposal requests about \$715,000 over five years (1) to complete the materials and website needed for teacher training, (2) to provide low-cost online teacher-training to 800 college teachers, (3) to provide stipends to 50 teachers who will use these materials in teaching statistics courses and provide written reports on their experience, and (4) to launch online teacher-training as an ongoing operation.

Intellectual merit: Most students taking statistics (1) are in non-STEM majors, (2) take their statistics in departments outside the traditional STEM disciplines, (3) are in departments that require statistics as part of their majors, (4) are in majors where observational studies are much more common than clinical trials, (5) are in majors that use statistical associations as evidence of causal connections, (6) see less value in statistics after taking the course than they did before, and (7) will get jobs that require them to read and interpret data.

The goal of this project is to modify introductory statistics to be of greater value to students in the social sciences and the humanities: to reform – if not revolutionize – the teaching of statistics in non-STEM disciplines; to revamp introductory statistics for greater relevance and appeal. The ultimate goal is to prepare students to read and interpret everyday statistics as part of their job and their life.

This will be done by helping students think critically about statistics. It will focus more on how confounding, definitions and bias can influence associations and statistical significance in observational studies. The emphasis is on what the statistics mean rather than on their calculation. This focus has a strong research basis. See Tintle et al (2013) on the centrality of confounding, Pearl's (2006) book *Causality* and Best's (2001) book arguing that all statistics are socially constructed by people with goals.

Broader Impact: By reuniting statistics with the liberal arts – by shifting the focus from deductive right-wrong reasoning to practical-inductive strength-of-evidence reasoning, this project can improve students' image of STEM. Students will use ordinary English to describe subtle ideas involving ratios, algebra and calculus that arise in traditional statistics and epidemiology.

By teaching students how to think critically about statistics in arguments, teachers can help them develop a life-long skill. This project has the potential to impact the 25% of ACT test takers who are proficient in math but are not interested in STEM. This project can set the stage for a new generation of statistical educators, improve students' attitudes toward statistics and create a new doorway to STEM.