

The General Education Category 4 Rubric calls for students to “illustrate historical and contemporary applications of mathematical/logical systems” as its first objective for student outcomes. After examining student submissions toward credit for SOC 202, I decided that the normal distribution, standardized z-scores, probability, and their interconnectedness represent a traditional (historical) application. I heretofore refer to this application as “NSP.” Another traditional application in statistics is comparison of groups on descriptive measures of central tendency and dispersion (heretofore referred as “MCTD”).

Although I have no hard data on the matter, I suspect that most undergraduate statistics courses cover NSP and MCTD because they are foundational. If nothing else, every published undergraduate statistics textbook I’ve encountered includes at least a partial chapter’s worth of discussion (if not a full chapter or more) devoted to NSP and MCTD. There is no guidance under the general education rubric for distinguishing “historical” from “contemporary” applications of mathematical/logical systems, thus the two applications selected for this assessment are somewhat arbitrarily considered “historical” in the sense that they are traditional applications covered in introductory statistics courses. I submit that “contemporary” statistical applications are probably misplaced in introductory statistics courses for the social sciences. Log-linear models, Poisson distributions, and relatively “new” analytic procedures such as these are typically not covered outside of graduate level seminars in the social sciences.

One of the exams in SOC 202 demands comprehension of NSP, because students must be able to calculate probabilities given z-scores. Two of the exam questions covering the NSP application are as follows:

- 1b) Find the percent and illustrate the area of the normal distribution that is between a $Z = -.82$ and $Z = -.99$
- 3b) What is the probability that the murder rate of a major U.S. city is 16 or more murders per 100,000 residents, given that 1992 murder rates (per 100,000 residents) for 74 major U.S. cities was normally distributed with $\mu = 20.8$ and $\sigma = 6.29$ (calculate, draw and label distribution used, and interpret)

Another of the exams in SOC 202 demands comprehension of MCTD, because students must be able to correctly interpret measures of central tendency and dispersion. For instance, one exam question reads as follows:

- 2) As the director of the local Boys Club, you have claimed that membership in your club reduced juvenile delinquency. A member of your funding agency has demanded proof of your claim before the renewal of your grant money. You interviewed random samples of members and nonmembers of the Boys Club with respect to their involvement in delinquent activities. Interpret the descriptive statistics. (Member and nonmember means, variances, standard deviations and group size are given)

Combining the exams in SOC 202, there were 12 questions tapping student knowledge of either NSP or MCTD. Three students in the class matched the selection criteria for this assessment, yielding 36 possible illustrations of “historical applications of mathematical/logical systems.” Students correctly completed those illustrations 20 out of 36 possible times (55.6%).

Another objective for student outcomes in the General Education Category 4 Rubric calls for students to “clearly express mathematical/logical ideas in writing.” Ten questions from the two exams required that students interpret statistical results in writing – some of these problems also required illustration of visual graphs. Ten questions for three students yield a total of 30 instances when they are to “clearly express mathematical/logical ideas in writing.” In 25 of such instances (83.3%) students correctly expressed their statistical results for problems. Note that in some of these cases, students’ answers to the problems were incorrect, but they articulated explanations for their answers in writing that were sound in light of the statistical application at hand. The mistakes were in calculation or misapplication of procedures.

A third objective for student outcomes calls for students to “explain what constitutes a valid mathematical/logical argument (proof).” In social science statistics courses, we do not require students to learn or apply “proofs.” The closest we come to this (and it is quite a stretch) in SOC 202 is requiring that students understand the *appropriateness* of statistical procedures and tools for the research problem at hand, and recognition of what critical consumers of information need to consider in making informed judgments. Two exam questions tap this, although somewhat indirectly. While students are not asked to choose the appropriate procedure to use for a research situation, they are asked to explain an important difference applicable in most research situations and statistical procedures for them. Another exam question asks students to identify criteria for communication of statistical interpretation. The questions read as follows:

- 4) Identify the criteria for the communication of interpretation of statistical results.
Explain the importance of each criterion from a consumer of information perspective.
- 6) Distinguish probability and frequency distributions by identifying the characteristics (need to be specific for each) that in comparison distinguish the two distributions.

Sadly, *none* of the three students were able to address *either* of these questions satisfactorily. This perhaps represents something to work on in SOC 202, but it could just as well be an anomaly given the small number of students who met selection criteria for this assessment.

Finally, the fourth objective for student outcomes calls for students to “apply higher-order problem-solving and/or modeling strategies.” Here again, there is real difficulty in extrapolating what we do in social science statistics courses to this objective. What are “higher-order problem-solving and modeling strategies”? What are the “simple” versions of these? My understanding of “modeling” strategies in statistical realms connotes a fairly broad range of analytic techniques and procedures, some of them fairly

straightforward (correlational path analysis of a theoretical – causal – “model”), others quite sophisticated (estimation of regression “models” and their variants, estimation of latent variable “models” using maximum likelihood techniques, embedded hierarchical linear “models”), and so forth. I suspect this is not what we are to be teaching undergraduate general education students. In the social sciences, we reserve such curriculum for doctoral level seminars.

I suspect that what is meant by “apply higher-order problem-solving and/or modeling strategies” is something quite more modest (but no less important) than what the verbiage strains to relay. Are we assessing whether our general education courses require students to think critically in applying, consuming, and/or calculating mathematical, logical, or statistical information in their everyday (professional, problem-solving) lives? To put it more succinctly, do we ask students to become more quantitatively literate than before taking the course? If so, SOC 202 does that.

Recommendations for future assessments:

Make the outcomes/objectives much more concrete. This can be accomplished in one of two ways. First, all stakeholders (instructors of category 4 general education courses, or their department representatives knowledgeable in category 4 curricula) are locked in a room until they decide on outcomes/objectives much more concrete than currently exist. This approach presents numerous (perhaps unavoidable) headaches, due to the presumption that general education courses of a particular category must somehow be “similar” (or that they require students to master comparable knowledge and skill sets). Among the difficulties is reaching agreement on: common objectives; language that articulates them; and what qualifies as satisfactory completion of such objectives. This requires enormous effort, time, and patience, to say the least.

On the other hand, the second strategy calls for a willingness to live with some diversity in our general education curriculum. We leave it to each discipline to designate its own objectives and outcomes. The advantage is that we side-step all-encompassing, “one-size fits all” assessment criteria. These ultimately do not provide much valuable feedback for anything or anyone – the current objectives/outcomes seem to represent a “color-by-numbers” exercise, where assessors match whatever color (outcomes) they see fit to each number (objectives). Perhaps letting each discipline develop its own criteria allows more idiosyncrasy across courses within a gen ed category than can be tolerated. But this might be ameliorated by outside assessment. If all disciplines must be assessed by at least one other person from outside, that would keep everyone “honest.”