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Students' Understanding of Statistical Inference: Implications for Teaching

Abstract

It was of concern to the researcher that students were successfully completing introductory tertiary statistics units (if success is measured by grades received), without having the ability to explain the principles behind statistical inference. In other words, students were applying procedural knowledge (surface learning) without concurrent conceptual knowledge.

This study had the aim of investigating if alternative teaching strategies could assist students in gaining the ability to explain the principles behind two tools of statistical inference: *P*-values and confidence intervals for the population mean. Computer simulations were used to introduce students to statistical concepts. Students were also introduced to alternative representations of hypothesis tests, and were encouraged to give written explanations of their reasoning. Time for reflection, writing and discussion was also introduced into the lectures.

It was the contention of the researcher that students are unfamiliar with the hypothetical, probabilistic reasoning that statistical inference requires. Therefore students were introduced to this form of reasoning gradually throughout the teaching semester, starting with simple examples that the students could understand. It was hoped that by the use of these examples students could make connections that would form the basis of further understanding.

It was found that in general, students' understanding of *P*-values, as demonstrated by the reasoning used in their written explanations, did improve over the four semesters of the study. Students' understanding of confidence intervals also improved over the time of the study. However for confidence intervals, where simple examples were more difficult to find, student understanding did not improve to the extent that it did for *P*-values.

It is recommended that statistics instructors need to appreciate that tertiary students, even those with pre-tertiary mathematics, may not have a good appreciation of probabilistic processes. Students will also be unfamiliar with hypothetical, probabilistic reasoning, and will find this difficult. Statistics instructors, therefore, need to find connections that students can make to more familiar contexts, use alternative representations of statistical processes, and give students time to reflect and write on their work.