Transfer Appropriate Instruction in an Introductory Statistics Course

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Background:

Statistics courses typically follow a similar sequence: the teacher provides instruction on a particular statistical test, including assigned reading, classroom-based instruction, and homework or other "practice" activities. Once a statistical test is "covered", the teacher goes on to the next statistical test. And so on. At various points in the course there are exams on the statistical tests covered to date. At the end of the course, there may or may not be a comprehensive final exam.

When students complete a basic course in statistics, one of the standard expected outcomes is that they be able to determine which statistical test is appropriate to which research design. For example, if a researcher completed a study in which she was examined the degree to which scores on the SAT-verbal test predicted final grades in an introductory English composition course, a student's statistics teacher would hope her student would know that a simple regression analysis was an appropriate statistical test.

Teachers who administer comprehensive final exams often ask "What went wrong! They don't know when to use a *t*-test, a correlational analysis, a *z*-test. I'm discouraged."

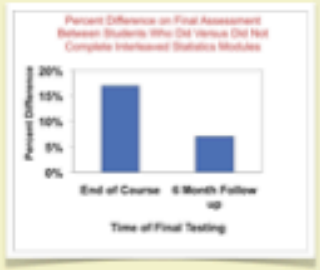
The difficulty might be that the method of instruction is not designed to address the expected outcome.

We implemented a possible solution. In this approach, course instructors provided students multiple opportunities over the semester to correctly identify whether a particular statistical test was appropriate for a given research design.

Method:

Participants:

Participants were undergraduate students enrolled in one of five introductory statistics courses (enrollment capped at 40). Three of the sections were randomly assigned to serve as a comparison group. Two sections served as the experimental group. Students in these two sections received the modified instructional sequence.



Procedure:

- In both course groups, students received instruction on the following statistical tests: *t* for single means, *z*, *t*s for dependent and independent groups, one-way ANOVA, correlation, regression, and chi-square.
- Two course groups:
  - **Comparison courses**: instructors taught their course in their usual manner.
  - **Experimental (modified) courses**: In addition to the regular instructional protocol, after a statistical test was covered, students studied an online workshop on that test, and then completed an online quiz in which they were asked to select an appropriate statistical test for a research design. After the next statistical was covered, students completed the workshop on that test as well as reviewed the workshop on the previous test. The quiz covered both statistical tests. This procedure was repeated across the semester.
- At the end of the semester, students in both course groups completed a 21-item comprehensive exam on the 8 statistical tests. The items were descriptions of research designs, followed by 8 alternative statistical tests. Students selected the test they thought was most appropriate for the research design.

Results and Discussion:

- The results are shown in the figure. At the end of the course, students in the two sections that received the modified instructional sequence performed 17% better on the 21-item exam than students in the three sections that served as the comparison group. (We have replicated this result in other sections of this course.)
- We conducted a follow-up six months after the course was completed (30% of the students in both groups participated). Students completed the 21-item exam again. Students in the modified instructional sequence courses continued to outperform their counterparts in the comparison group sections of the courses (7 % better).
- The results from this quasi-experimental study (students were not randomly assigned to comparison or experimental sections of the course) show potential benefits of using an instructional method in which students continually go back to previously studied statistical tests and then are asked to make decisions about which tests are appropriate for different research designs. Follow up studies, with improved experimental designs, are in progress.
- Laboratory and applied research on spacing and interleaving of study may help us to improve students' success at selecting appropriate statistical analyses for different research designs.

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Suggested Reading

Taylor, K., & Rohrer, D. (2010). The effect of interleaving practice. *Applied Cognitive Psychology, 24*, 837– 848.

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