

Seeing the forest through the trees: Overarching principles to help struggling students

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In my experience the most important thing is to encourage students to talk through the whole problem without using a single number or equation, so they can say, for example: “We want to know if group A is bigger (significantly bigger) than group B. The numbers are interval or continuous, and there are different people in each group (they’re independent) so we’re going to use a t-test for independent samples, and if we get a big number (positive or negative) for t (and therefore a small number for p) that will mean that it’s very unlikely that we got such different means by chance, so we will reject the hypothesis that nothing’s going on (the groups are the same) and instead say that group A is in fact bigger than group B”.

The above sentence incorporates 90% of what they need to have mastered. There are two sections—the part where the student decides which test to use (organization) and the part where they describe what they’re testing and why. The nice thing is, *what* they’re testing and *why* is 99% the same for all tests, so once they get those concepts, each test, while it requires different inputs, should be clear in its output.

Topic:	They Learn:	I emphasize:	Catch Phrase
Null hypothesis	Start to search problem for Null hypothesis—often confuse Null and Alternative, or conclude opposite of what they’ve found	Figure out in words what you want to know first. Either one is really bigger than the other, or it’s chance. Chance is the Null hypothesis.	“Nothing interesting is going on” or “What’s the Boring option?”
Tests for categorical and continuous numbers	Lists of equations Students tackle each equation separately, and soon they are overwhelmed.	Make it clear that they are making the same steps, and coming to the same conclusions, for, say, a Chi-Square and a regression, just with different numbers.	“What kind of numbers are these?”
All statistical tests	Lists of Equations	In introductory statistics, all inferential statistics we teach cover basically two questions: 1) Is there a mean difference between groups? 2) Are two variables related to each other?	“Is it Bigger? How much Bigger?” and “Are they related? Does it depend?”

What is the Question you're asking?
Summarize or Infer/Compare?

Inferential Statistics

Descriptive Statistics



What kind of numbers do you have?

Continuous

Mean Median or Mode
2) Variance, S.D., or Range
3) Confidence Int.

Categorical

Contingency Table

What question are you asking? Compare groups or check relationship?

Is it bigger?

Does it Depend?

What kind of numbers do you have?

What kind of numbers do you have?

Categorical

Continuous

Categorical

Co

Chi-Square Goodness of Fit

Z-test
T-test (one-sample, two-sample, paired)
Confidence interval
ANOVA

Chi-Square test for independence

C
R

(SCOTS)

What will you be able to say after test?

Therefore what is Null Hypothesis? What are your

Flow-Chart to Organize All Introductory Stats Material
What's left out? Well, other kinds of numbers (Bi-modal, ordinal if you