

## Re: resampling methods are serious procedure?

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- *From:* Old Mac User <[chendrixstats@xxxxxxxxxx](mailto:chendrixstats@xxxxxxxxxx)>
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Illiwhacker...

I have a problem grasping what you meant. You wrote...

Using re-sampling to teach classical statistical techniques, while it may 'work', therefore only reinforces the problem, by giving credence to these techniques in the first place.

In my experience teaching "comparative data" (inference) via resampling strips off the mystique and levels the playing field. It virtually eliminates the "gotchas" typically spewed by profs. to their undergraduate students. By this I mean touting how much they know as compared to their struggling students.

procedures go against intuition shows how 'difficult' the whole subject is, and hence how much need we all have of their expertise.

Indeed classical methods (or is it classical teaching) propagates "look at how difficult this is" and "if you don't pay close attention to all the little rules and regulations you will stumble and fall."

When I can use a method of teaching (no matter where it may come from) that inspires students and makes them want to learn more I'll use it. True whether I'm teaching "statistics" or certain difficult subjects in reaction engineering.

Some years ago I was asked to teach at a science camp for middle-school kids. This was a local thing, sponsored by our country school system. My assignment was to do a seminar in "statistics". The kids attending this are certainly much brighter than the average, and many of their parents worked at for the same company and at the same technical center where I was employed.

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This was a challenge. The time allowed was, as I recall, no more than 1 hour.

I came to the idea of teaching estimation and comparative data (comparing averages). With equations? I don't think so. Building on some teaching methods I'd used for engineers, scientists, and managers I decided to use a couple of shoeboxes with M&Ms in them... about 1000 – 1200 M&Ms in each box. It was resampling time!! I let the kids draw M&Ms (blindfolded... no picking and choosing) and proceeded from there. The fraction of red M&Ms in one box was different from the fraction in the other box. It almost goes without saying, they were excited. Especially when I told them they could eat the candy at the end of the day (I did this seminar four times for different groups).

But more than the candy, they learned. I explained how they could use resampling to compare "data" (averages, fractions, proportions, and more) in real-life circumstances... things they see or do "every day". They learned, and they were exciting about learning. No equations. No fine print. Just "go for it."

The fun part came when some parents came to me days later (the camp lasted 5 days) and asked me what I'd taught their kids. They said the kids were wound up about "it" and tried to teach their parents what they'd learned. One even wanted to do a science project built around the concept of resampling.

What more could I ask?

I honestly believe that if profs. would teach basic statistics using resampling methods and then explain that there are other (classical) methods that involve using equations and some "fine print" they would end up with some inspired students. Some might even get so inspired that they want to take higher-level courses in statistics.

Why, oh why, do we insist that entry-level students learn things that are truly not intuitive. I'd like to see them get inspired before moving too far upstream.

I know this violates an important principle... "Spinach first, dessert later".

The same is true when teaching certain subjects in engineering (I'm a chemical engineer and also a statistician.) The best engineering profs. I found at the undergraduate level taught without using equations until the students were inspired and ready for the spinach. By far the best prof. I ever had was in a first course in chemical engineering. He taught and inspired and when it came time to take a test the questions went somewhat beyond what we'd learned in the classroom. In short, we had to add common sense and good judgment to engineering technology. At first this was frustrating. But all who attended his courses will agree "Dr. Littlejohn made us successful."

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Among other things, we learned to never, never, accept "facts" at face value until we have verified them.

I wish profs. teaching statistics would do the same.  
In too many instances students are taught to use computers and software and push data through "analysis" without asking questions about how such data came to be and may be "wrong" with it.

Nearly all the data that comes to me is flawed in some significant way. Thanks to Dr. Littlejohn I examine it, "play with it", and look for gross errors. (Key-entry errors and things that just don't look right".

I know this deviates a long way from the matter at hand... resampling. But in too many instances I've seen well-intentioned people "draw vast conclusions from halfvast data". Just read it out loud.

Be of good cheer. OMU

"Comforting the afflicted and afflicting the comfortable."

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