

Lessons Not Learned at University #3

Drawing the right statistical conclusion

This lesson was learnt at University when *The Student* was back at University doing a post-graduate degree. He had a reasonable understanding of statistics but the knowledge had been picked up piecemeal over the years and he wanted a sounder base on which to build. There wasn't time to do some of the many statistics courses on offer in the Department of Statistics, but there was a unit of basic statistical analysis for post-graduate students. His fellow students were either foresters or social scientists so nobody was going to argue that all were numerical geniuses.

The Lecturer gave this course and he was one of those rare birds, he was a practical statistician. At the end of the course there was an examination. Students had a week to pick up the paper and then a week to answer the questions. *The Lecturer* knew that the students wanted to improve their statistical understanding and skills, not just pass exams, and so were unlikely to cheat. There was simply nothing to gain.

One question provided data on the brightness of clothing after it had been washed. There were various levels and types of dirt, various washing machines, and a wide range of washing powders.

The Student took on this question and ran Analyses of Variance, investigated the residuals, and battled the data. Of the many alternatives tested only a few were statistically significant and they were generally interaction terms. His conclusion was that there was no difference between the washing powders but that more data and more detailed analyses might, just might, find something statistically different.

The Lecturer marked the paper and called in *The Student* to provide feedback. He started by commenting that *The Student* had found an interaction that *The Lecturer* had not. But, he said, there were basically no statistically significant differences between treatments. "After all if 100 analyses have been carried out you should expect 1% or 5% aberrant results¹, but what is the conclusion? What should the consumer do?" Before *The Student* could make a fool of himself with an over-hasty reply *The Lecturer* simply said "choose the cheapest". The analysis done *The Student* had drawn a conclusion, and it was perfectly correct, but it hadn't gone far enough. He had missed the practical implication.

Lesson: Analyse all you want, but think about the issues and draw the right conclusion and try to envisage how the outcome would apply in the real world.

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¹ The Type I, Type II error issue in statistics.