Discussion:

I have made comments on each paper in this session, and conclude with a summary of the entire session.

Clarke: " Studying Variability in Statistics via Performance Measures in Sport"

Steve Clarke continues in his lifelong quest to use statistics to understand sport, and to use sport to teach statistics. Clarke's paper is an excellent example of both aspects of his work. The paper documents several surprising sport phenomena that are understood by the creative application of some simple measures of variability. At the same time, the examples demonstrate why measures of variability are so important to understand, not only for analytical strategies, but for descriptive measures as well.

The remarkable thing is that the multi-billion dollar sports industry worldwide can be understood so much better with a few basic statistical strategies, and yet these strategies are little known by sports analysts, and seldom taught by statistics instructors. Those of us responsible for this pedagogic lack tend to think that once we teach students about measures of variability, they will see how to use them in their area of interest. Steve's paper provides examples that have often been overlooked by both students and teachers of statistics. Unless students are motivated to internalize variability measures through interesting examples, they will not be able to use them properly in any applications. I am not merely saying real data is useful for teaching variability – I am saying that for students to gain a useful understanding of variability, they need to be involved with applications for which variability measures are of primary interest to the students. The mathematics of variability modeling does not convey the necessary mental stimulus. Even applications that treat variability as an adjunct to location measures will tend to distract the student from the interpretation of the variability measure per se.

Most of us are teachers of statistics, and we will regularly be trying to convince students that measures of variability are important for data analysis. You may use arguments to show that the variability of measurements is the key to making reproducible comparisons. But how often are you able to show that measurements of variability are themselves key descriptors of a process? Clarke shows that measurements of variability are not only useful for comparing means, but also descriptive of important aspects of a sport.
A good example is that variability of golf scores at a particular hole is a more important measure of the difficulty of the hole than the average number of strokes required. And he provides many other examples in golf, triathalons, basketball, cricket, tennis, football and baseball. Clarke has drawn our attention to the wealth of motivation available for teaching that is available from the sports industries that engage such a large portion of our population.

Clarke also includes the role of simulation in assessing or predicting sport outcomes. This is another under-taught strategy. We use simulation to demonstrate CIs or the sampling distribution of the sample mean, but we can also demonstrate sport outcome variability in situations where we know the underlying model, and compare this variability with real life sport contexts. This is another way to inform students of the surprising effects of randomness in sport and, by implication, in other contexts.

In summary, this is an excellent paper for any instructor, but particularly for those at the beginning of their teaching career. If I had read this paper in 1969, my teaching would have been much improved!

Swartz: " A Graduate Course in Statistics in Sport"

When sports examples are used for teaching statistics, they tend to be used in very simple contexts, and often in first courses. But as any statistical consultant knows, there is no such thing as a "routine application of statistics". A serious look at almost any data analysis problem will inevitably present analytical complications that should be explored if time permits. Swartz' graduate course using sport contexts reinforces this point. The list of techniques involved include things like MCMC, CART, hierarchical models, Brownian motion and the Gauss-Seidel algorithm. This is not a course for beginners! It is a real graduate course for graduate students of statistics.

The course procedure involved guided experiences with review of 24 published articles in sport. Each article was reviewed with the instructor providing background material in the sport context as well as stimulating discussion about statistical techniques unfamiliar to students. Students were required to prepare presentations in the last third of the course, and teams were used to encourage peer discussion of the ideas. Even though such presentations are always stressful for students, they apparently felt the experience was interesting and worthwhile.

The course described by Swartz is an example of a "process" course rather than a "product" course. The idea is that students learn a useful skill by engaging in a sort of detective experience, where data-based information is rooted out using whatever techniques can be found. Those who worry about the coverage of a prescribed list of topics will be afraid that many topics will be missed. But one has to consider the purpose of statistics education at the graduate level: Are we still teaching basics, or are we teaching the process of finding techniques appropriate to the data-based problem at hand? If the latter, then the curriculum can be defined as a series of case-study-explorations rather than a series of topics in advanced statistics.

Everson "Teaching Regression Using American Football Scores"

Commercial sports gambling is very big business in North America. In spite of the fact that expected returns are generally negative, there appears to be great interest in combining spectator sports with sports gambling. Even those who do not wish to participate in gambling can find much of interest in the data on sports betting and outcomes. For example, we can see the extent to which sports outcomes are predictable, and the extent to which outcomes depend on apparently "random" influences, by examining this data.

The gambler's interest in sports is based on predicting outcomes. The gambler would like to use whatever information is available to try to find situations in which the return might be positive, at least on average. An important lesson to teach students about regression methods is that it is for prediction or predictive models (and not simply "curve fitting"). So a situation in which prediction is needed is ideal for motivating regression. Everson uses this motivation to introduce regression of sports outcomes based on one or two pieces of key information.

The contextual information that the student needs to understand to take advantage of this teaching context is non-trivial. While sports gamblers are comfortable with the point spread as summarizing the progress or outcome of a football game, many students will find this a new idea. However, once mastered, the context does provide for some interesting regression results. One result is that the booky's spread offered before the game is very close to an unbiased estimate of the outcome spread. The booky's business success depends on this capability, but it is still surprising that the booky is so successful at it, in view of the apparent chaotic nature of sports contests. Another result is that the quarter time spread has no additional predictive power once the half-time spread is used. While this seems necessary logically, it is nice to see the machinery of least squares, applied to real data, complying with logic.

This paper is an interesting introduction to the use of statistics in sports gambling, and for students sufficiently motivated to learn the rules of the game, it will help to convey the utility of linear regression.

Yamaguchi, Sakaori, Watanabe:

"A Trial of Statistical Education using Sports Data in Japan"

In an effort to change the perception of statistics, a working group in Japan has proposed making more use of sports statistics. Apparently the social science students have an especially hard time coping with a mathematical approach. This paper describes the classroom use that could be made of some baseball data.

In Japan and in North America, part of the interest in baseball derives from the numerical summaries of the game and its players. Because of this it is natural to use baseball statistics to reach math-alienated social science students. The authors use the distribution of types of pitches (fast ball, slider, et al) to show how a mixture distribution can reveal its components. They also point out the futility of ignoring components in using mixed data to describe a process.

Another use for the baseball data suggested is to discuss the correlation-causation difference. They comment that batters with high home-run rates also have high strike out rates, so the tendency to swing at a pitch causes both outcomes.

Summary

I have commented on the relevance of the papers in this session to the teaching & learning of statistics. As an even briefer summary, I would suggest the following:

1. The Clarke paper explains how sports contexts can be used to demonstrate the importance of measures of variability, and to illustrate the use of simulation in studying complex phenomena.
2. The Swartz paper shows that the sports context can motivate the study of a wide variety of advanced statistical procedures and can stimulate interest in these techniques.
3. The Everson paper shows that the sports gambling context can provide real world demonstrations of subjective probabilities having some objective validity. It also shows how regression can be used for prediction – and not only for estimating predictive relationships.
4. Yamaguchi et al show how real data on pitch distributions in baseball provide a good example of a mixture distribution, and suggest how this might be used in the classroom.

Overall, the message is that sports contexts are excellent for demonstrating the implications of unexplained variation – in other words, randomness – and that we should exploit this area to motivate enthusiastic learning of statistical strategies.

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