Abstracts and Short Presentations

Teaching Biometry in Agricultural Science

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Statistics is not a subject about which the students in the Faculty of Agriculture at the University of Queensland have a burning desire to learn. Therefore, biometry (as statistics in the biological sciences is often called) has to be taught in a very context orientated, practical way. This does not mean that it is a soft option in comparison to the applied statistics subjects taught in Departments of Mathematics.

Various strategies for the effective teaching of biometry at both undergraduate and postgraduate levels are discussed. The emphasis is on a basic understanding of the underlying concepts and applicability of statistical techniques to biological data. Computers may have taken away some of the tedious calculations, but interpretation difficulties still remain. An important objective is to encourage and facilitate useful interaction with professional statisticians when these students are back in the real world designing experiments, analysing their own data, or even critically assessing published reports.

Teaching Statistics to Students in Agriculture

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Statistical methods applied in agriculture have a long tradition. The work of R Fisher on the Design and Analysis of Experiments and other Statistical Methods was of particular importance (Fisher, 1925). Statistical methods in agriculture have also exerted an influence on the development of the Theory of Sampling (Yates, 1947), and stimulated the evolution of Sample Survey Methods. Also, laboratory work in various fields of research with modern equipment and technology has led to the development of new and sophisticated statistical methods.

The need for statistics education of agricultural students is generally accepted. The only dilemma is how to implement it. There are different approaches and the

system of teaching varies from one university to the other even in the same country.

What should a curriculum of statistics be like for agricultural science students? The answer depends very much on the school, the number of hours for lectures, the local conditions, and the students' major subject. These features account for the existence of numerous different curricula.

The teaching programme in the Faculty of Agriculture, University of Novi Sad is indicative and will be used as an example. The Faculty enrols about 800 students every year with an entrance examination. A one-semester course of statistics for students in the biology group (field crops and soil management, livestock, plant protection and fruit, vegetables and ornamental plants) has 75 hours. A workshop is common to each discipline. Before they attend that course they are required to complete 105 hours in mathematics including 20 hours in probability. Students of agricultural economics attend two courses in statistics of 105 and 75 hours respectively, and two courses in mathematics with a total of 120 hours. There is one 60-hour course for students in agricultural mechanisation and one for students in water resources. Their courses in mathematics have a total of 240 hours. For graduate students in biometrics there is one course of 60 hours for biology groups and two courses each of 60 hours in mathematical and statistical methods for graduate students in agricultural economics.

A quarter of the course for biology groups contains descriptive statistics, the rest concerns linear models with statistical inference (hypothesis testing and estimation), and a brief introduction to design of experiments and sample surveys. In their first course, students of agricultural economics are offered similar topics and also one on demography. The second course covers sample survey, regression analysis, time series analysis, and elements of decision theory. Courses at graduate level are more advanced and relevant to the specialisation of students.

Teaching can be run outside universities, for example at agricultural institutions. Generally, at universities teaching is academic and implemented in common programmes at various levels. In non-university institutions teaching is often more extensive and with uniformly oriented attendees who are expected to be better motivated.

The development and application of statistical software contributes to the change in teaching practice. At present, personal computers are widely used by the teaching staff, but financial considerations and routine are often an obstacle to bringing computing facilities closer to students. Technological development will undoubtedly accelerate the inclusion of computers in teaching agricultural statistics.

Training of teachers of agricultural statistics: The success in statistical education of non-statisticians depends very much on teachers, their background, motivation, and experience. What basic knowledge is required for a teacher of agricultural statistics? That problem was discussed in a broader context by Rao (1982). The training of teachers of probability and mathematical statistics causes few arguments, but for teachers of applied statistics, opinions often diverge. Generally it is agreed that the latter teachers should have a sound theoretical background and be well acquainted with agriculture. Such a teacher receives his academic degree either in statistics (if he is not trained in this discipline) or in agriculture (if he is a statistician by training).

The training of teachers may be a problem for countries without proper statistical educational institutions. Many countries have faculties of sciences with mathematical departments which run specialised courses in probability and mathematical statistics. However, teaching and postgraduate studies are sometimes narrowly directed, so their

suitability for training teachers of applied agricultural statistics is an open question. One solution can be to send young theoretical statisticians to developed countries to get MSc or PhD degrees. Another solution is to organise graduate studies for teachers in agricultural statistics, either at a university or sometimes, with some advantage, at some other institution which guarantees a high level of teaching.

Organisational problems and staff: In many countries agricultural students are taught statistics by faculty departments with their own staff. There are also cases when a department offers courses in statistics to all faculties in the university.

Grouping statisticians in an independent statistical unit is an advantage. There can be a greater guarantee that teaching will be at a satisfactory theoretical level and will show experience of applications; research in statistics of the academic staff will be more productive and rational. In this case, statistical education of students will not be on stereotyped problems which narrow the scope of statistics. As most agricultural students will not be professional statisticians, statistical education should lead to a wide knowledge of the discipline and its importance in social development.

When statistics teachers are dispersed in various departments there is a lack of communication among them. In time they usually lose the necessary contact with their own professionals and the motivation for continuing education diminishes. On the other hand it is not unusual that faculty members prefer to entrust statistics teaching to their colleagues in the subject matter rather than to a teacher with a proper academic statistical education and training, partly because they find it easier to communicate with a colleague of their own profession. Often the statistical education of such teachers leaves very much to be desired.

Another advantage of an independent statistical unit is that it is practically autonomous in recruitment of new staff. This offers the possibility of a productive and extended development in teaching and research alike. These matters are discussed by Loynes (1986).

References

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Teaching Short Courses in Biostatistics and Epidemiology

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This presentation describes the author's experience in teaching short courses on a variety of topics in biostatistics and epidemiology. A historical perspective is given, together with a discussion of ingredients necessary for a successful short course. Also, difficulties experienced are described.

Statistics Education in Medical Schools in Japan

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In Japan, fundamental statistical concepts such as mean and variance are learned in arithmetic in elementary schools and mathematics in the middle school. In science and social studies classes, moreover, statistical data are presented frequently. In high schools, probability and statistics is one of five courses offered, but it is elective. Medical students graduate from college in six years, of which the first two are spent on general education and the last four on medicine. A general statistics course is required in the first two years and each specialty - pharmacology, hygienics, etc. - requires a specialised statistics course.

There are two problems that need attention in regard to the general statistics course. First, some students have studied statistics and probability in high school while others have not. With total university course hours declining, there is no additional time for statistics in general education. At the author's school, a test is given to evaluate prerequisite knowledge for the statistics course.

The second is whether the general course should consist of lectures on general mathematical statistics or more practical training on medical statistics. The author's school makes available personal computers and has students apply statistics to research problems in their specialty. University medical departments differ from medical schools in that at the former, medical students take a general statistics course with other students, while basic statistics courses at the latter tend to focus on applied medical statistics.

Experience with a Problem-Based Introductory Course in Biostatistics

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The undergraduate medical programme at McMaster University is run in small groups solving problems, with only a minimum of lectures. Some graduate courses are run on similar lines. In September 1988, the introductory Biostatistics course was revised to follow this format as part of the graduate programme in Epidemiology.

Problems were based on recent studies conducted by faculty researchers. At the first session, students were given a list of concepts which were to be covered, and which studies best illustrated these. They were told the background to the project and the methods, and given access to the data set. Working in groups of 9 or 10 with a tutor, they used the problems to learn basic concepts and techniques of statistics. Students were evaluated by their weekly performance in groups, by a multiple-choice questionnaire, and by a problem solution involving both oral and written components.

The evaluation of the course by the students showed that on the whole the approach was successful. Some revisions, however, were thought desirable.

These will be made for the 1989 running of the course. Student performance and satisfaction will be measured and compared with the previous year's results.