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This issue of 'IASE Matters' focuses on two examples of the training of Agricultural Statisticians. Readers are reminded that contributions to this IASE publication or to its sister publication which appears in the International Statistical Institute's Newsletter are welcomed. These should be sent to Anne Hawkins, 64 Bedford Court Mansions, Bedford Avenue, Bloomsbury, London, WC1B 3AD, UK [Tel/Fax: +(0)71-636-0058, E-mail: teexash@ioe.ac.uk]

TEACHING STATISTICS IN THE AGRICULTURAL SCIENCES - A CZECH PERSPECTIVE -

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Introduction

At the University of South Bohemia, the Faculty of Agriculture offers three branches of study; general agriculture, business achievement, and travel and services economy. Some 200-250 students have been admitted yearly to the first year of studies. Depending on their entrance examination results, they start either bachelors or masters degree courses, taking three or five years respectively.

The programmes of study include both obligatory and also a specified number of faculty-based subjects (selected by the student). In addition, the student may study an optional subject from those offered by the individual departments. Statistics has been an obligatory subject in the first year of the masters degree courses. It is neither obligatory nor one of the faculty-based subjects for bachelors degree students.

The teaching of statistics, and more particularly of applied statistics, has been encouraged within the Faculty of Agriculture as new courses in user-disciplines have been added to the more traditional biological courses already offered. For instance, in 1993 the business achievement branch was opened and in the next school year courses in accounting and in finance will be introduced. A course concerned with the agricultural products market is scheduled to start in 1995. As well as the obligatory masters level course, several different statistics courses have been started in response to requests by individual departments and older students. A course in *Statgraphics* is one such course.

Problems Teaching Statistics to Agricultural Science Students

In common with other faculties, where mathematical courses are taught even though the faculty does not specialise in that field, we found that; (a) most students disliked mathematical theory, and (b) students only considered to be important knowledge of the branch that they have chosen.

Furthermore, until recently, statistical education has been hampered by the relative lack of computer literacy among students. Until 1989, universities and colleges were equipped with Czech made computers and secondary schools did not have any computers at all. In a recent anonymous survey conducted in their first statistics seminar, 110 students from the general agriculture branch were asked about their experience of using computers. Only 36% claimed to be unafraid of computers. 66% had not used a computer at secondary school, and only 5% felt able to work on a computer (plus 34% who felt able to work 'a little' on a computer).

International Association for Statistical Education

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More general problems for teachers of statistics in Czech Republic universities arise because they have to contend with a language barrier (the German language was preferred for a long time in the Czech Republic), and with a lack of foreign study literature - monographs, self-study books, statistics textbooks, etc.

Some Solutions

The Faculty of Agriculture at the University of South Bohemia bought IBM PC computers in 1990, and in the same year the statistical package was bought. The student computer laboratory was also opened in 1990. In September 1993 the computer network was installed and the University was connected to the Internet. Other problems may be solved by choosing appropriate educational methods which help students to understand statistics and its use in their future careers. What follows provides a brief insight into the teaching methods adopted for teaching the obligatory statistics course to masters degree students in Agricultural Sciences.

Lectures

Statistics is taught twice a week and there are 15 weeks in a semester. We have already left the classical way of teaching - there are no lessons full of monologues in the statistics lessons now. Instead, we continuously try to create dialogues with the students, both by using many provocative questions and also by using practical situations in which it is necessary for the students to apply so far "unknown statistical methods". Students help to derive these new theoretical approaches.

Preparation for this form of lesson is very important and difficult. It is necessary to break through the traditional passivity of Czech students. They are reluctant to admit that they do not understand, and they are not used to cooperating with the teacher. Every lesson must be carefully prepared in order to provide students with all the information that they need, while at the same time allowing them to discuss the problem so that they will gain more understanding of the subject matter.

Seminars

Seminars usually occupy two hours each week. The aim is to develop knowledge gained during lessons, to teach students to use study literature, to define problems correctly, to draw conclusions and to defend ways of choosing statistical methods. The seminars are taken in a computer laboratory equipped with IBM

PC386 machines, connected by a Novell network. There are at most 20 students in a seminar group. They use the statistical package *Statgraphics* and other programs such as *FoxPro*, *QuattroPro*, etc. They work in pairs, each pair working as a processing team. Every team uses a study text. There is also a disk with many datasets available for the students' use. Members of the Department of Economics and Statistics are the authors of the study literature and most of the datasets have been prepared during research activities, mainly in agriculture and in the processing industry.

Every seminar is divided into two parts. In the first part, teams solve their own simple tasks - they apply their theoretical knowledge, then compare their results with those obtained from the computer. The aim is to uncover the substance of statistical methods, as well as becoming acquainted with computer-based analysis.

In the second part of each seminar, a large database is analysed. This database is introduced at the beginning of the semester and students use it during the whole semester. In this semester, for example, we are working with data on a herd of 166 cows. The data comprises 28 variables, both quantitative and qualitative. Simultaneously, as the students gain deeper knowledge of statistical theory in the lectures, they also use it in the seminars to get new information about regularity and relationships among the indicators of quality breeding.

Tutorials

In the past year, we have introduced two "student tutorials in statistics". Although the teacher was present, the tutorials were led by students in the final year of their masters degree studies, who had prepared their theses in the Department of Animal Husbandry or in the Department of Animal Physiology, using statistical methods to analyse their experimental data. For example, a project dealing with animal ecology entitled "The study of mutual sucking of breeding cows" was discussed in the first tutorial.

In these very successful tutorials, the students explained the technical aspects of their research and described how the data were collected, and the statistical methods they had used, which might include descriptions of, or research into, "new" methods (for example, the application of Fisher's factorial test, which had not been taught in the students' statistics course). They

also gave advice on how to speed up computer processing of the experimental data.

In conclusion, our observations indicate that students are interested in this way of working and they come to realise step by step that statistics is not just a "boring" mathematical course, but a useful information resource.

ON-THE-JOB TRAINING OF US AGRICULTURAL STATISTICIANS

For the following information, I [AH] am indebted to Frederic A Vogel, Director, Estimates Division, National Agricultural Statistics Service, United States Department of Agriculture, Washington, D C 20250-2000 [Tel: +202-720-3896, Fax: +202-690-1311]

No US university offers a degree programme in agricultural statistics. Therefore, the National Agricultural Statistics Service (NASS) of the US Department of Agriculture (USDA) primarily recruits people who have a BS or an MS degree in an agricultural discipline and who have also completed a core programme of mathematics and statistics. After being placed in an agricultural statistician entry-level position, each person is given an Individual Development Plan (IDP) that they must successfully complete before being promoted to a position of journeyman-level statistician.

The National Agricultural Statistics Service also has a mathematical statistician job series for which people with MS or PhD degrees in mathematics and statistics are recruited. These people can become dually qualified as both mathematical and agricultural statisticians by also completing the requirements in the Individual Development Plan. Many of the senior managers have met the requirements in both job series.

The developmental objectives and activities in the IDP are the same for everyone. A combination of additional courses as well as on-the-job training activities is required. The speed at which the activities are completed depends on the knowledge and skills that the individual recruit brings to the job and on his or her on-the-job performance. The individual's progress is guided and monitored by an appointed supervisor.

The developmental objectives are grouped into the following major areas, each having a number of associated developmental activities;

I - History and Purpose of USDA & NASS - Understand the reasons why USDA was established, the changes that have occurred in its structure and the functions of NASS and USDA agencies with related missions. Be able to locate data to respond to requests for information on NASS and USDA programmes.

II - Knowledge of Agriculture - Understand the production and marketing of crops and livestock. Detailed knowledge of every aspect is not required, but the employee should have a general knowledge of agriculture in order to converse intelligently with producers and data users; recognise obvious errors in data while editing questionnaires and reviewing summaries; understand the reasons for changes in levels when evaluating survey indications; stay informed of changes in production practices and the effects of environmental and economic factors; and learn about the local agriculture after transferring to a new State.

III - Knowledge of Statistics - Understand the fundamentals of the design and development of sample surveys; establish survey objectives; determine sample survey data output requirements and accuracy standards; decide which sampling frames (area, list) provide best access to observations; probability sampling frames; data collection techniques; estimation; non-sampling error analysis. An employee must have the ability to analyse data, interpret survey indications and prepare forecasts, estimates, and reports relating to assigned programme.

IV - Knowledge of Survey Theory and Procedures - An employee should be knowledgeable on survey concepts, procedures, and interviewing techniques associated with surveys conducted by NASS, have trained an enumerator and office staff to conduct a survey, and have supervised a major survey.

V - Knowledge of Automated Data Processing The employee successfully manages or processes data by using automated systems. The employee understands and follows Departmental and Agency ADP security regulations on protecting sensitive data, access phone numbers, ID's, passwords, account numbers and backups.

VI - General Knowledge and Abilities - The employee has the basic skills needed by any technical position in NASS such as the ability to: work with others to present programme briefings on survey results; write clearly and persuasively; organise work and manage time effectively; represent the Agency effectively in both formal and informal gatherings.

Frederic Vogel reports that, although the initial development of the content of the Individual Development Plan and its implementation were difficult, it is now in place and working well. The following table gives some idea of the range of developmental activities completed by each recruit. Task-oriented experience also features strongly in the other three developmental objective areas.

Examples of Developmental Activities from the NASS Technical Development Programme

<u>II Knowledge of Agriculture</u>	<u>III Knowledge of Statistics</u>	<u>IV Knowledge of Survey Procedures and Procedures</u>
<p><i>Attend Courses</i> in Crop Production, Agronomy, Animal Husbandry, Agricultural Marketing and/or Prices.</p> <p><i>Read Terms and Definitions</i> in Estimates Manual.</p> <p><i>Be responsible for</i> Weather/Crop report for a season.</p> <p><i>Prepare - County Estimates</i> for Crop/Livestock items - <i>Acreage/Yield Production Estimates/Forecasts</i> - Prices Paid/Received Estimates (monthly/quarterly and season average).</p> <p><i>Gain Experience in > 1 State</i> - with NASS or prior experience. Field travel through various production areas.</p> <p><i>Personally interview/visit</i> with producers.</p> <p><i>Attend commodity meetings.</i></p> <p><i>Prepare commodity releases.</i></p> <p><i>Prepare written response to requests</i> for NASS and other data.</p>	<p><i>Attend Courses</i> - Introduction to Statistics/Principles of Statistics - Sampling Procedures/Theory.</p> <p><i>Read</i> - "Sampling Frames for Agriculture", Journal of Statistics, Area Frame Design for Agricultural Surveys, - Sampling, Estimation, Analysis Concepts in Estimates Manual.</p> <p><i>Attend Training Sessions</i> on Sampling and Estimation Concepts, Area and List Frame Sampling, Data Analysis and Collection.</p> <p><i>Review Analysis Output</i> for Crops, Stocks, Livestock for Quarterly Agricultural Surveys.</p> <p><i>Prepare List Sampling Frame Parameters</i> - Data Select, Classify, Sample Select. Review Segments for Problem Segment Action.</p> <p><i>Review List Sampling Frame</i> for Duplications.</p> <p><i>Do Frequency Distributions</i> to Determine Edit Limits.</p> <p><i>Construct and Review Time Series Charts</i> to Examine Relationships Between Indications.</p>	<p><i>Prepare List Sampling Frame Maintenance Transactions</i> - Major/Minor Name Change.</p> <p><i>Review Exception Reports.</i></p> <p><i>Conduct Area Frame Interviews</i> - Complete Segment in June Survey.</p> <p><i>Conduct List Interviews</i> - telephone, personal.</p> <p><i>Attend Survey Concept</i> Regional/National School.</p> <p><i>Supervise Major Survey.</i></p> <p><i>Train Enumerators.</i></p> <p><i>Prepare Edit Parameters.</i></p> <p><i>Edit/Code Survey Questionnaires.</i></p> <p><i>Review/Update Edit Runs.</i></p> <p><i>Develop, Track, and Adjust Costs to Meet Survey Budgets.</i></p>

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ANNOUNCEMENTS

Last Call for ICOTS-4. The Fourth International Conference on Teaching Statistics will be held July 25-30, 1994 in the modern Congress Centre in Marrakech, Morocco. For further information, contact the head of the local organising committee; *Mr. EL GHAZALI Abdelaziz, INSEA, PO Box 6217, Rabat-Instituts, RABAT, Morocco [Tel: +212 7-77-09-15, Fax: +212 7-77-94-57, Telex: 36119 M]*

Arab Meeting on Teaching Statistics. An Arabic-language meeting on teaching statistics and informatics at all levels will be held at CAPMAS in Cairo, Egypt on July 20 and 21, 1994, as a satellite meeting to ICOTS-4 in Marrakech, Morocco. The conference topics are; Teaching statistics and informatics for pre-university education, Teaching statistics and informatics for university education, Teaching statistics and informatics for non-statisticians, Applied training in the field of statistics, Applied training on informatics and EDA. *For more information, please contact the chair of the programme committee, Professor Abdelmegid M Farrag, through CAPMAS: Fax (202) 604 099 or by post, President Office, Central Agency for Public Mobilisation and Statistics, P.O.B. 2086, CAIRO.*

Competition for Young Statisticians from Developing Countries

The International Statistical Institute announces the seventh competition among young statisticians from developing countries who are invited to submit a paper on any topic within the broad field of statistics. The authors of the winning papers will be invited to present their papers at the Beijing session of ISI in 1995, with all expenses paid. The rules governing the preparation of papers, application forms and full details are available on request from the ISI. (See address at foot of page 1 of *IASE matters*.)