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CHAPTER 11 THE TEACHING OF STATISTICS IN VIETNAM

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CHAPTER 1

The Training of Statisticians in the United Kingdom

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1.1 THE EDUCATIONAL FRAMEWORK

The United Kingdom consists of four countries: England, Scotland, Wales and Northern Ireland. There are of course cultural differences between these countries, and indeed within them, and some legal and administrative separation between them – for example the Scottish school educational system has rather different features from that of England, and the tradition in Scottish universities is also somewhat different. Nevertheless, compared to many, it is rather homogenous. The population (1981 Census) is 56,300,000.

Education at Primary and Secondary levels has been free and compulsory for many years: at present it is compulsory between the ages of 5 and 16, promotion from one year to the next being automatic. The traditional pattern for state education has been for primary education to be organised on a general basis from ages 5 to 10, with a transfer to secondary school at age 11, where the programme is organised on a subject basis. These secondary schools might or might not take pupils beyond the compulsory stage, up to age 18. More recently considerable variety has arisen, with, in some cases, Middle schools catering for the age range of about 8 to 12, followed by senior schools. The great majority of schools are now 'comprehensive', admitting pupils of all abilities from the neighbourhood. The post-16 situation has changed too, with the setting up in some areas of sixth-form colleges (to cater for largely academic students) or in a few cases tertiary colleges (to deal with the whole range of academic, vocational and technical needs of the 16 to 18 year olds). Moreover growing numbers of students leave school at 16 and complete their education at Colleges of Further Education, which deal not only with their needs but also with continuing education and various types of leisure learning activities. The structure of the educational system is determined partly by the central government – which contributes the greater part of the financial support, controls the accreditation of teachers, determines pay-scales for teachers, and maintains standards via the activities of the Inspectorate of Schools – and partly by local government – which decides the location and age-range of schools in their area, and appoints the teachers. In the past curriculum has been in principle determined by the individual schools, though there has always been substantial pressure exerted on them at secondary level by the external examination system and of course some social and political

pressure from various sources; it seems likely that a national core curriculum will be drawn up and insisted upon in the near future.

In addition to the state system just described there is a quite small but significant private system – consisting mainly of the confusingly-named public schools, though there is also a small number of schools associated with churches; in 1983 about 7% of all pupils were in the private sector. These are largely free of state regulation as far as academic questions are concerned, but are of course subject to the same pressure of external examinations as are the state schools, so that, although there are many differences of detail, for present purposes such differences can be ignored.

For anyone likely to go on to higher education, and so in particular for most of those likely to become statisticians, the last four years (i.e. until the age of 18) of secondary education are largely concerned with preparation for public (external) examinations, divided into two types – one taken usually at age 16 and the other normally at age 18 (though there are no rules about age.) At 16 the more able students take the General Certificate of Education at Ordinary Level (GCE O-level): there are no restrictions in the number or the combinations of subjects which may be taken, but typically between 5 and 10 subjects will be offered, including mathematics, some science and a language, by those intending to continue in academic education. Then, at age 18, GCE A-level (Advanced Level) is taken, typically in three subjects but sometimes in two or four (or even five); the choice of subjects is unconstrained. There have been several proposals over the years to reform the system, in order to reduce the often-criticised degree of specialisation, which is particularly noticeable in the later years; however, no agreement has yet been reached. The GCE is administered by Boards, each of which may, for a mainstream subject like mathematics, offer examinations based on several different syllabuses; however these syllabuses either contain already, or will in the near future, a 'common core'. The O-level examination and some others are to be replaced in 1988 by the General Certificate of Secondary Education (GCSE) which will be aimed at students of a wider range of ability and will be administered somewhat differently, and will place considerably greater emphasis on practical/project work, but otherwise will be of a generally similar type.

1.2 HIGHER EDUCATION IN GENERAL

Institutions of higher education in the UK are of two types: the universities (46 in number) and the polytechnics (31). These differ substantially in their administration, and in the source of their financial support (though both are almost entirely dependent on public funds). But as far as the training of statisticians is concerned the only difference worth recording is that because the polytechnics have only relatively recently begun to offer degree programmes not many professional-level statisticians have come from them. The usual age of entry is 18, and in 1983 between 13% and 14% of this age group entered degree programmes in a

university or polytechnic. For most kinds of employment (including statistics in most cases) a first degree marks the usual end of full-time education.

The *minimal* requirement for entry to a degree course is 5 passes in subject examinations in the GCE, including 2 at A-level, but for most programmes considerably higher demands are made at A-level. (Mature students, defined as those aged over 21 at entry, are treated individually and formal requirements may be waived.)

In the UK, degree programmes, with only rare exceptions, are divided fairly rigidly into segments of one year in length, each one of which must be completed before beginning the next. In both universities and polytechnics the most common length of a first degree course is 3 years (except of course for professional subjects like medicine, architecture and so on), although in a number of cases 4 years is required. In many subjects – particularly technical ones – a master's degree by coursework, examination and dissertation (based on a short project) is available, and usually extends over one academic year; a given university or polytechnic will offer only a limited range of such courses however.

The system in Scotland is rather different from that in the rest of the UK, and a brief description is called for. A substantial proportion of students leave school at age 17, after taking the Scottish Certificate of Education, Higher grade, and enter a (Scottish) university immediately. The university course is then usually four years long, at the end of which a student is at the same stage as one completing a university course elsewhere in the UK. Others stay on at school until the age of 18, as they would in England.

1.3 STATISTICS IN HIGHER EDUCATION

At first degree level there are few programmes in statistics alone; there are, however, many in which 'Statistics' appears as a part of the title and many more in which statistics forms a significant part of the overall programme. For example, in many mathematics degrees it is possible to choose to specialise in statistics almost completely in the final year; various combinations of statistics with other subjects – such as economics and statistics, or geography and statistics – exist; many economics and business study curricula contain large amounts of statistics. Each institution has its own detailed programme, and here it is clearly not practicable to do more than indicate by example what it might contain. An example is given in Appendix I, which is perhaps not completely unrepresentative. Economics courses are often very quantitative, and graduates from them may go on to become statisticians, but it seems rarely or never to be the case that the course itself is called a statistics course. The taught master's degree or its equivalent (usually M.Sc.) is much more rigid. There are 14 university and 1 polytechnic courses of this type, and, although there are a few which aim at a particular specialisation such as social statistics, the great majority are quite similar to one another, each being a general course, but

with greater or lesser emphasis on medical statistics, on computing, on theoretical matters and so on. Again, an indicative example is given in Appendix II. The so-called 'Blue Book' (Postgraduate Statistics in Britain), published annually by the Committee of Professors of Statistics, describes M.Sc. courses and Ph.D. programmes in the UK and Ireland.

1.4 OTHER ROUTES TO QUALIFICATIONS

The Institute of Statisticians was founded in 1948, one of its major aims being to provide opportunities to obtain qualifications in statistics at a time when few universities offered them. There are significant numbers of statisticians qualified in this way, particularly in commerce and industry, although it is now uncommon for new members not to have, in addition, more conventional academic qualifications. While setting syllabus and examinations, the Institute has never provided instruction: this has been offered by various public or private bodies as demand was demonstrated. It may be of interest to note that the Institute has developed a substantial overseas membership, for much the same reason, partly no doubt because local conventional opportunities for obtaining statistical qualifications have been insufficient, and partly because it is possible to take Institute examinations in mid-career. Further details about the syllabuses and examinations are given in Appendix III.

Qualifications awarded by B/TEC (Business and Technical Education Council), on the basis of approved courses and examinations, are another possibility particularly for those at lower levels with a strong applied interest; many of these include statistics. They are roughly comparable with passes at GCE A-level or in first year university examinations, but are very strongly task-oriented, the syllabuses declaring that a student 'will be able to fit a regression line', etc.

1.5 VARIETIES OF STATISTICIAN AND THEIR BACKGROUND

As the designation *statistician* is not limited by law, and is only mildly restricted by custom, a wide variety of activities is covered by it, with a correspondingly wide variety of kinds of training. They can be divided, at least broadly, into five categories: official, commercial/financial, industrial/technological, biological/agricultural, and academic. We shall deal with these in turn.

1.5.1 Official Statisticians

The Government Statistical Service (GSS), about 500 in number in the professional grades, has changed its character over the years. Those who entered some time ago – and are therefore in the more senior positions – are predominantly from an economic background. As specialisation has

increased, and as statistical training has been more widely offered in the universities, so has the proportion of the entrants trained specifically in (mathematical) statistics either at bachelor's degree level, or master's degree level, or both, gone up until virtually all are now in this category. Of those trained in statistics only at the master's degree level, the majority are mathematicians or have taken mathematics jointly with some other subject, but there is a wide variety of other kinds of training represented – economists, psychologists, geographers, physical scientists, engineers for example. A small number is recruited each year of those who have insufficient, or indeed no, statistical training, provided that they are strong enough in mathematics to cope with a post-graduate course. These Cadet Statisticians are then sent to do a master's degree course. There is, of course, a small number of other specialists, not statisticians, in the GSS, such as systems analysts and computer experts.

The Civil Service provides a great deal of in-house training, much of it through the Civil Service College. The courses offered there are usually short – less than two weeks in length – and may be in technical areas, such as advanced multivariate analysis, or in more general ones such as management techniques.

1.5.2 Commercial/Financial Statisticians

This group is so disparate that it is difficult to say anything useful about their training. It may well be true, in fact, that the majority of those called statisticians have little or no formal training in the subject at all. There is, however, a noticeable sprinkling in this group of those who have obtained their training outside the full-time higher education system, for example by taking the examinations of the Institute of Statisticians (see above).

1.5.3 Industrial/Technological Statisticians

From the late 1940's to perhaps about 1970 there were several large and very strong – world-famous in some cases – groups made up mostly of a mixture of former mathematicians, physical scientists and engineers, though, here again, as time passed the groups were becoming more homogeneous, consisting more and more of people trained from the beginning in statistics. But with recession in the economy and the consequent need to reduce costs the groups were cut back, and in some cases disappeared, and from then on the statistician's function was partly taken over by specialists in more fashionable subjects such as operations research, management science or computing (and sometimes there has seemed to be a belief that the computer itself could replace the statistician). Whether there will be a swing of the pendulum back, towards recognising the unique contribution that a statistician can, or at least should, make, remains to be seen. There is one area for which this does not seem to be the case – indeed numbers continue to increase: the pharmaceutical industry. Training for this does not seem to have developed into a detectable specialism, though one should in any case probably

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not expect it to be differentiated from that for the next group of statisticians.

1.5.4 *Biological/Agricultural Statisticians*

There is no undergraduate programme anywhere in the country which can be said to specialise in this area, but some offer a small number of relevant options. At master's degree level there are a few which are directed particularly in this direction and several others which offer a substantial optional component; apart from the traditional design of experiments, incidentally, the biological side is much more evident than the agricultural.

Apart from the pharmaceutical industry, mentioned previously, employment here is mainly in publicly funded centres, often research centres. Statisticians in this specialisation are a mixture of those with a general statistical training and, particularly among young people, those who have followed one of the courses just described, with the occasional example of a biologist converted in an informal way.

1.5.5 *Academic Statisticians*

The outline structure of the training of this group is almost obvious: for all but a very occasional exception, a first degree in mathematics or statistics; a master's degree for, probably, the majority, though direct entry to the Ph.D. programme is very common; and then a Ph.D.

1.6 CONTINUING EDUCATION

With the exception of the Civil Service, employers and training institutions have not in the past made many efforts in this direction. There is now, however, a climate of opinion generally favourable to this, and a number of universities, polytechnics and colleges, as well as private companies, have begun to offer short courses to introduce new areas or to update old ones. This area will almost certainly continue to grow, and longer courses will then be arranged.

APPENDIX I *Special Honours Undergraduate Programme in Mathematics at the University of Sheffield (for those taking statistics)*

		hours
1st year	Pure Mathematics	96
	Probability and Statistics	96
	*Applied and Computational Mathematics	96
	*Other subjects can be substituted for this.	
2nd year	Pure Mathematics	144
	Probability and Statistics Theory	48
	Methods	48
	Probability Modelling	24
	Decision Theory & Bayesian Inference	24
3rd year	Courses totalling selected from (Pure Mathematics)	240
	Statistical Model Building	40
	Operations Research I	20
	Methods in Industry	20
	Sampling Theory	10
	Time Series	10
	Multivariate Analysis	20
	Further Inference	20
	Non-parametric Methods	10
	Bayesian and Comparative Inference	10
	Practical and Applied (Project work)	40*
	Demography	10
	Clinical Trials	10
	Survival Data	10
	Genetics	10
Operations Research II	40	
*equivalent		

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APPENDIX II *M.Sc. Programme at Sheffield University*

The following is an excerpt from the handbook.

Postgraduate students in Statistics at Sheffield are offered a set of core courses with further non-core courses in probability and statistics.

- | | | |
|-----------|-----|---|
| Core: | C1 | Analysis of Data (40) |
| | C2 | Statistical Methods (30) |
| | C3 | Review of basic material of Probability and Statistics (20) |
| | C4 | Probability Modelling (10) |
| | C5 | Inference (10) |
| | C6 | Sampling Theory (10) |
| | C7 | Time Series (10) |
| | C8 | Generalized Statistical Modelling (10) |
| Non-Core: | N1 | Operations Research/Simulation (20) |
| | N2 | Methods in Industry (20) |
| | N3 | Statistics in Medicine and Biology (20) Term 1 |
| | N4 | Statistics in Medicine and Biology (20) Term 2 |
| | N5 | Design of Experiments (20) |
| | N6 | Multivariate Analysis (20) |
| | N7 | Non-parametric Methods (10) |
| | N8 | Bayesian and Comparative Inference (10) |
| | N9 | Further Probability and Stochastic Processes (10) |
| | N10 | Further Time Series (10) |

The numbers in brackets refer to the number of lectures associated with each course. Most courses will have, in addition, tutorials at the rate of 1 for each 2 lectures. Students must select courses to attain a total of 220 lectures. All the core courses must generally be included in the choice, although exemptions may be allowed if it is clear that a student has covered the topics already in sufficient detail to render the courses purely of a repetitive nature. Course C1 however will be compulsory.

The relevant examinations will be held in the third term. Students will also have to complete a dissertation which will in general be an analysis of some practical statistical project. This will start at the end of the second term, but the bulk of the work for this will be done after the examinations. Students will present an oral account of their findings early in September and the dissertation must be submitted by 30 September.

APPENDIX III *Qualifications conferred by the Institute of Statisticians*

There are 3 levels, following a recent restructuring.

- Ordinary Certificate in Statistics
- Higher Certificate in Statistics
- Graduate Diploma in Statistics

nominally requiring 1, 2 and 2 to 3 years of study respectively. The examinations for the Graduate Diploma, which is widely recognised as being equivalent to an honours (first) degree, are arranged as follows:

- | | |
|--------------------------------|----------|
| Statistical Theory and Methods | 2 papers |
| Applied Statistics | 2 papers |
| Optional Subjects | 1 paper |

These optional subjects consist of either (a) Statistical Computing or (b) two chosen from Biometrics, Medical Statistics, Industrial Statistics, Operations Research, Economic Statistics, Econometrics.