

# The Coming of Age of Statistical Education

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## Summary

This paper outlines developments in statistical education in the period preceding the formation of the International Association for Statistical Education (IASE) 1991, and takes a tentative look at the future. The first section reviews the history of the ISI's Statistical Education Committee from its setting up in 1948 to the birth of the IASE in 1991. The second section attempts to identify some of the underlying factors contributing to the rapid growth of interest in statistical education during the last two decades or so. The third section gives a personal view of some of the issues the IASE may have to confront during its first few years of existence.

*Key words:* Statistical education; Statistical training; History of ISI; History of statistics.

## 1 Introduction

From August 23rd to August 24th, 1993 the International Association for Statistical Education (IASE) held its first scientific meeting in Perugia, Italy. Its first General Assembly was held shortly afterwards in Florence as part of the 49th Session of ISI. The Association forms a new international professional body within the broader field of science and mathematics education, the first specifically devoted to statistical education, as well as a new section of the ISI. With its creation, statistical education can be said to have come of age.

The aims of the present article are to review the events leading up to these developments, to reflect on their causes and to anticipate some of the issues the new Association may have to face in the future. In particular, since the formation of the IASE also signalled the end of the old ISI Education Committee, it seems an appropriate occasion to review the work of the latter Committee over the forty three years of its existence. This task is undertaken in Section 2 below; the remaining two sections examine factors affecting the growth of the statistical education movement (Section 3) and issues for the future (Section 4).

I would like to emphasise that the views expressed in this article are personal ones, and are not intended to reflect the views either of the ISI Education Committee, or of its successor the IASE Interim Executive.

## 2 The ISI Education Committee 1948–1991

### 2.1 Foundation

The ISI Education Committee was set up in 1948 (although it did not meet until 1949), as part of a series of constitutional changes aimed, among other things, at increasing the ISI's mandate to undertake educational activities in statistics and to collaborate for this purpose with UNESCO and other UN agencies.

Although statistical education had been a concern of the ISI since its inception in 1885, it was the setting up of the Education Committee which marked the beginning of a systematic education programme. The programme has changed quite substantially over the forty three years of the Committee's existence and although there have been several previous reviews of its activities (see below) it seems worthwhile to trace the changing character of its work over the whole period.

The activities it undertook can be broadly classified under three main headings

- (i) direct involvement in teaching or training projects;
- (ii) publication of books, pamphlets, newsletters etc;
- (iii) sponsoring of conferences, round table discussions.

We shall examine these in broadly chronological order, recognising two main periods in the committee's history: the early period (1949–1976), which was largely dominated by concerns for augmenting the supply of statistical staff for government; and the second period 1976–1993, during which the Committee increasingly turned its attention to promoting statistical education in schools and universities.

The early period has been documented in earlier reviews by Nixon (1960), Goudswaard (1964) and Zarkovich (1976). The "reappraisal" in the last of these provoked a series of new initiatives by the Committee and it seems therefore to mark a suitable change point. The first part of the second period is covered in reviews by Gani (1979, 1987). The final years of the Committee's existence have not been reviewed previously.

Despite the numerous reviews there is a lack of systematic documentation of the Committee's work and history. With the assistance of Daniel Berze from the ISI Permanent Office, I have tried to make a start on such documentation by providing chronological lists of the Committee's chairmen, and of the main conferences and meetings it has sponsored. These lists are set out respectively in Tables 1 and 2 below.

**Table 1**  
*Chairmen of Education Committee (Taken from Reports of the Bureau to the General Assembly 1948 on.)*

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1948–1954	–	S.A. Rice
1954–1960	–	P.C. Mahalanobis
1960–1963	–	H.O.A. Wold
1963–1969	–	G.M. Cox
1969–1973	–	J. Durbin
1973–1977	–	G. Goudswaard
1977–1979	–	A.E. Sarhan
1979–1987	–	J.M. Gani
1987–1991	–	D. Vere-Jones

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**Table 2**

*Major Conferences on Statistical Education Sponsored by the Education Committee*

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(A)	ROUND TABLE MEETINGS	<p>Round Table Discussion on “The University Teaching of Statistics in Developing Countries” held at The Hague, 26–29 August 1968.</p> <p>Round Table Meeting on “New Technologies in Teaching of Statistics” held in Oisterwijk, The Netherlands, September 1970.</p> <p>Third Round Table Conference on the Teaching of Statistics, Vienna, 30 August–4 September 1973. Proceedings: <i>Statistics at the School Level</i>, edited by L. Råde.</p> <p>Fourth Round Table Conference on the Teaching of Statistics, Warsaw, 29–31 August 1975. Proceedings: <i>The Teaching of Statistics in Schools</i>, edited by H. Breny.</p> <p>Fifth Round Table Meeting on Teaching of Statistics. Calcutta, India, November 30–3 December 1977.</p> <p>Sixth Round Table Conference on the Teaching of Statistics, Canberra, 20–23 August 1984. Proceedings <i>Teaching of Statistics in the Computer Age</i>, edited by L. Råde and T. Speed.</p> <p>Seventh Round Table Conference on the Teaching of Statistics. Budapest, 23–27 July 1988. Proceedings: <i>Training Teachers to Teach Statistics</i>, edited by A. Hawkins.</p> <p>1992 Round Table Conference on the Teaching of Statistics. Proceedings: <i>Who Should Teach Data Analysis and Why</i>, edited by Lionel Pereira-Mendoza.</p>
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(B)	ICOTS CONFERENCES	<p>1st International Conference on Teaching Statistics, ICOTS 1, 9–13 August 1982, at University of Sheffield, UK. Proceedings edited by: D.R. Grey, P. Holmes, V. Barnett and G.M. Constable.</p> <p>2nd International Conference on Teaching Statistics, ICOTS II, 11–16 August 1987, at University of Victoria, Canada. Proceedings edited by: Roger Davidson and Jim Swift.</p> <p>3rd International Conference on Teaching Statistics, ICOTS III, 19–24 August 1990, at University of Otago, Dunedin, New Zealand. Proceedings edited by: D. Vere-Jones, assisted by B.P. Dawkins and S.A. Carlisle.</p> <p>4th International Conference on Teaching Statistics, ICOTS IV, 25–30 July 1994, at Congress Palace, Marrakech, Morocco.</p>

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## 2.2 *The Early Period 1949–1976*

The establishment of the United Nations and its Agencies during the immediate postwar years saw the ISI passing over a number of its previous responsibilities to those agencies. There was a need for the ISI to redefine its role and seek new functions. In 1948 Dr. Stuart Rice, the President at that time, strongly advocated a major emphasis on statistical education. He persuaded the UN Statistical Commission to advance proposals to UNESCO for a shared responsibility for the development of statistical education. These proposals were subsequently adopted by UNESCO and included provisions for ISI to assist in “a survey of the needs for education and training in statistics and the formation of an international programme to meet these needs”. At the same time the statutes of ISI were revised to incorporate, among other things, an explicit responsibility for the promotion of statistical education. The Statistical Education Committee was set up toward the end of 1948, and held its first meeting in conjunction with the 26th session of ISI in Berne, 1949. One of its major tasks was to consider Rice’s paper (Rice (1949)) “The Furtherance of Statistical Education” which he submitted both to ISI and to UNESCO. This paper provided the basis for the ISI’s involvement in statistical education for the next decade and longer.

At that time an underlying concern in both the UN and the ISI was the need for better statistical information from the developing countries. A major hurdle to obtaining such information was the lack of staff within those countries to undertake the necessary data collection and analysis. This shortage applied at all levels, from primary interviewers and enumerators to statistical experts who could assist in the design and analysis of the surveys. Many of the early steps taken by the ISI in response to Dr. Rice’s report reflect this concern.

One of the early issues which had to be resolved was the division of responsibility between the ISI and the UN Agencies. It was soon agreed that the operating function, that is responsibility for developing and running the training facilities, would be taken over largely by the UN Agencies, while ISI retained responsibility for the broader, more nebulous task of “promoting statistical education”. This included in particular the development of university programmes in statistics, from which teachers for the training facilities would be recruited, and of advanced courses providing information about new procedures and methodology. The dissemination and fellowship programmes referred to under (iii) and (iv) below also fell into the “education” category and were considered a special responsibility of the ISI.

From the beginning, therefore, it was recognised that, while the ISI could bring together an impressive range of expertise, it would be less easy for it, in view of the loose allegiance of its members and the absence of full-time staff, to directly organise or take part in educational projects. Nevertheless, during this early period in particular, the Education Committee was involved in a number of quite substantial projects, and in the disbursement of substantial funds. In addition to the survey on education needs referred to in the initial paragraph, which ultimately appeared in 1957 in the guise of a UNESCO report edited by P.C. Mahalanobis, Gani (1979) refers to a “Survey on the Teaching of Statistics for Developing Countries” carried out for UNESCO in 1973, and there may have been other exercises of this kind. By and large, however, the role of the ISI was seen as an advisory and seeding one, and this has remained a characteristic of its involvement in statistical education up to the present time.

The initial grant from UNESCO to ISI was for \$5000 (US) and was to be followed by annual subventions, which reached figures as high as \$40,000 (US) and ultimately settled at around half of that figure.

The most important activities undertaken during this early period can be summarised as follows (see the reviews cited earlier for further details).

- (i) The establishment of an International Statistical Education Centre in Calcutta intended to serve the countries in the Near East and South-East Asia. Calcutta was selected

because Mahalanobis was able to offer the backing and facilities of the Indian Statistical Institute; subsequently he was able to persuade the Indian Government to contribute substantially to the funding of the Centre. ISI was represented on the governing body of the Centre and part of the Centre's funding was channelled through the ISI and the Education Committee. The general purpose of the Centre was "to give further instruction to selected students . . . who have already acquired a basic education in statistical principles, to equip them either (a) to operate effectively in organising and conducting statistical training in their own country or (b) to serve in administration or technical posts in government agencies . . ."

A second ISEC was established a few years later in Beirut, when it became clear that needs in the Middle East could not be adequately met through the Calcutta ISEC alone. Since then, numerous further training centres have since been set up, but without the ISI's direct involvement.

- (ii) The organisation of short courses and seminars associated with the ISI's regular biennial meetings and elsewhere. The first seminar was held in conjunction with the 1949 meeting in Berne and others followed regularly. These paved the way for the Round Table Conferences and other meetings listed in Table 2. The Round Table Conferences are now held as satellite meetings associated with the ICME (International Congress on Mathematics Education) Meetings. Since their inception in 1984, the ICOTS Conferences have been the major ISI education meetings. Nevertheless, some sessions on educational themes have been held within the main ISI meetings also.

Bearing in mind the wide range of topics canvassed at these different meetings, and the cumulative effect of such activities over an extended period, the holding of such meetings must count as one of the most important and effective ways in which the ISI has contributed to "the furtherance of statistical education". Progress has come primarily from the benefit to individuals of participating, meeting colleagues and sharing ideas; the published volumes have generally had limited sales beyond those to participants.

- (iii) The running of a fellowship scheme for more advanced training. This programme never really came to fruition, owing to lack of substantive funding. Nevertheless, for a number of years, the ISI was involved in handling both applications for positions in the Calcutta and Beirut Centres, and more general applications for UNESCO assistance in pursuing advanced study in statistics.
- (iv) The production and dissemination of teaching aids such as bibliographies, references, texts, etc. The primary vehicle for the dissemination of such information was the ISI Review, which published and updated regular bibliographies on different aspects of statistics, as well as carrying a regular section devoted to statistical education and training. The ISI also assisted in the development of model curricula for university and other statistics programmes. Perhaps the best-known ISI Publication from this period was Kendall and Buckland's "Dictionary of Statistical Terms" (see e.g. the 4th edition, 1982).

Even by the end of the first period, i.e. by the mid 1970's, the education programme had considerably diversified from its original rather narrow focus on training statistical staff for the developing countries, no doubt reflecting in part the growing diversification in the ISI membership itself. Both university and school education had received attention through the Round Table Conferences. Bibliographies and other teaching aids in a wide range of special topics had helped to foster the development of advanced training and research. The numbers of statistical personnel being trained for the developing countries had increased greatly, although the basic issue which had preoccupied the education programme at the outset, namely the inadequate number of trained statisticians in the developing countries, was still far from resolved. The major role within this extended training

programme has been played by the UN Agencies, but the ISI had tried to sustain its guiding and coordinating function, and to set up opportunities for discussions and exchanges of viewpoint. It had little direct voice on the activities of the international training centres, with the exception of ISEC Calcutta, which continued to receive part of its funding through the ISI.

### 2.3 *The Second Period (1976–1991)*

I have taken the second period to start from Zarkovich's (1976) "reappraisal" of the ISI education programme. Zarkovich saw the ISI as the only international body with the competence to guide the future growth of statistical education, and strongly urged that it should take a more active role, at all levels. Some movements in these directions had been made earlier, but his paper acted as a cue for the ISI to give them more prominence.

The new directions became particularly evident after Joe Gani became Chairman of the Education Committee in 1979. Important work was accomplished by a number of task forces set up under the Committee's general direction. Two of the most important of these were the Task Force on Teaching Statistics at School Level (TOTSAS), led initially by Vic Barnett and subsequently by Gottfried Noether, and the Task Force on International Conferences in Statistical Education, led initially by Lennart Råde and subsequently by Kerstin Vännmann. Other task forces were concerned with the work of the international statistical training centres, and with statistical training at universities and technical institutes.

The TOTSAS group established a regular newsletter which was circulated to interested school and university teachers. It helped to establish the journal "Teaching Statistics" (first issued in 1979) and to support the work of Peter Holmes and colleagues in the Sheffield International Centre for Statistical Education. In 1982 the Task Force published a collection of reviews, edited by Vic Barnett, on "Teaching Statistics in Schools Throughout the World", while a companion volume on "The Training of Statisticians Round the World" was edited by Bob Loynes and published in 1987.

Some of the most important developments drew on the energy and organisational skills of Lennart Råde as leader of the Task Force on Conferences. Råde had been involved in several of the earlier Round Table Conferences, and was actively working with local school teachers in Sweden. His experience helped the Task Force to refocus the programme of Round Table Conferences, and to draw up plans for the First International Conference on Teaching Statistics (ICOTS). Aided by a seeding grant from the Education Committee, it was held in 1982, and its success led to the inauguration of a regular series of meetings on a four-yearly cycle. This cycle was designed to interleave with the four-year cycles of the ICME Conferences, which also contained sections on statistical education, and to which some of the Round Table conferences became attached as satellite conferences.

The ICOTS conferences are arguably the most important project initiated by the Education Committee over the period of its existence. They bring together statistics teachers at all levels, from within all disciplines, and from all continents. They provide an opportunity for teachers struggling with the day to day teaching problems, as well as those fighting for acceptance of statistics within the school and other programmes, to meet together, share ideas, gain heart and insights from others. In recent years, assisting participants to attend these conferences has been a high priority for use of the ever-decreasing UNESCO funding. At the same time the Conferences provide a venue for specialists in the philosophical, psychological, and didactical problems of teaching statistics to meet at the research level and to communicate their findings and ideas to teachers.

Under Gani's leadership the Education Committee showed clearly how much could be accomplished with modest funds by judiciously selecting key initiatives. Gani jocularly refers to these seeding activities as the "gadfly" role of the Committee, but I think that it was just in this role that the Committee proved to be of greatest value to the statistical education movement, and at no time

more successfully than during the period of his chairmanship.

The last few years of the Committee's existence formed a link between the extensive innovations which preceded, and the setting up of the IASE as an independent organisation. The period was marked by two major external trends: the increasingly difficult financial position of both the ISI itself and the international funding agencies (especially UNESCO), on which the education programme depended, and the rapid development of statistical education in schools and universities.

The major meeting during the last four years was the ICOTS 3 Conference held in Dunedin, New Zealand, in 1990. Despite the distance, it attracted some 564 participants, 315 of these from outside New Zealand. As with the other ICOTS conferences it involved extensive behind-the-scenes work in terms of programme planning, organisation and fund-raising. A feature of the preliminary activities, carried over from the ICOTS 2 Conference, was the activation of a network of "National Correspondents", one or exceptionally two from each country, to act as liaison between the international organising committees and local statisticians, universities, and statistical societies.

The Proceedings of the ICOTS 3 Conference, as also of the last two Round Table Conferences, were published by the ISI, on the basis of locally produced camera-ready copy and a local printer. Although the costs of preparing and printing Proceedings in this way are modest, up to the present they have been partially subsidised by the UNESCO subvention. It had been hoped that such efforts might become financially self-supporting as experience was gained in production and marketing aspects but so far this has not occurred.

The main vehicle for dissemination of information about statistical education became the ISEN Newsletter, in extended form, with Mary Regier as editor. The TOTSAS newsletter was discontinued as a separate item, while re-publication of the directory of short courses was deferred until a clearer demand for it was indicated. At the same time the work of the two task forces on statistical education was wound up, not because of lack of activity in the school and university areas, (rather the reverse, in fact) but because the seeding function of those groups seemed to have been successfully accomplished and the Committee wished to take up new ventures.

A major project with which the Committee was involved during this final period was the ISI Video Project. Arising out of earlier efforts by Gani and others to interest backers in a TV series on "The World of Statistics", it was picked up and given new life in 1987 by the incoming Director of the ISI Permanent Office, Carlos Jarque. Jarque was able to obtain funding from the International Development Research Centre in Canada for a feasibility study on the use of video-based technology in training primary-level statistical staff in developing countries. At the same time Ken Bryson was "loaned" to ISI from the US Bureau of the Census to work on this and other projects. The initial phase of the study involved selecting two videos for training purposes from material already available, and testing them in situ in E Africa. An account of his experiences and impressions from the trialling work is given in Bryson (1991).

While the preliminary stage was proceeding, strenuous efforts were made to find sponsors for the substantive stages. In the end, however, the money to close the "funding gap" could not be found, and the project had to be abandoned. The difficulties experienced point to the fickleness of international aid funding and the problems facing an organisation such as the ISI, with only a skeleton staff at the Permanent Office and other expertise available only at a distance, in competing for international funding.

The last major issue during the Committee's final years was the debate over, and preparation for, the new ISI section on statistical education. Initially, I was sceptical about this suggestion, fearing that it might cut across existing sections and hamper the ability of ISI as a whole to speak on educational matters. What changed my mind was the open meeting held to discuss this topic at the close of the ICOTS 3 Conference. The group there, which included teachers, government statistical staff, academics and practising statisticians, was adamant that an international association for statistical education was needed, and would inevitably come into existence whether or not it was associated

with ISI. The opportunity was there for the ISI to incorporate it as a new section if it wished—for the ICOTS Conferences and other activities of the education programme had established the ISI as the leading international organisation in the statistical education field. Within the ISI, the new organisation could benefit from the support and experience the ISI family could give it, while the new section could bring into the ISI new members, particularly those associated with school and technical education and teacher training. Persuaded by these and other arguments, the Education Committee threw its weight behind the ideas of a new section and concentrated its efforts on smoothing the way for the new section to come into being.

The credit for putting forward these ideas, not once but insistently, belongs to Mary Regier, who subsequently chaired the Task Force of the ISI Council charged with preparing draft statutes for the new Association. It says much that this complex task was accomplished in the short time that remained after ICOTS and before the next General Assembly of the ISI, at its 48th Session in Cairo, in September 1991.

The proposal to form the new section was duly put to the General Assembly and accepted. This created the bizarre situation of a new Association with full statutes and rules, but no members. To allow a foundation membership to be established, it was agreed that an Interim Executive should be set up to oversee the transition from the Education Committee to the new Association. The upshot was that the outgoing Education Committee, with a somewhat altered constitution and expanded membership, stayed on to perform this function. The need for continuity was the more important in that many matters were on-going, including preparations for ICOTS 4 in Morocco, the Round Table Conference in Québec, the ISEN newsletter, and oversight of the funding from UNESCO and the Indian Government, all of which needed to be reviewed and reconfirmed in the light of the new organisation of educational matters within the ISI.

#### 2.4 *Retrospective*

In summary, since it was set up in 1948, the Education Committee has played a not undistinguished role in the affairs of the ISI. It has been more active in some periods than in others, and the focus of the education programme has changed from the relatively narrow one of training statistical staff for developing countries to the broadest consideration of statistical education. It has made its greatest contribution, I believe, in consistently drawing attention to key issues. In doing so it has had the assistance, among its Chairmen and other members, of some of the most eminent and forceful statisticians of the second half of this century. Here ISI's greatest strength shows up most clearly, namely its ability to bring together statistical leaders of all nationalities to discuss problems in depth and from widely different points of view. It has been at its least successful in trying to establish itself as an operational group. Here the disadvantages of not having a core of professional staff on permanent positions, and of having to rely on the efforts of committee members, frequently with many other responsibilities, and widely scattered over all quarters of the globe, tell heavily against it.

In the final section of this article I shall return to the question of just how the new Association might seek to carry on the work of the Education Committee, and some of the problems likely to face it in the first few years of its existence. Before doing so, however, I would like to reflect a little on some of the factors which lie behind the rapid development of interest in statistical education over the last decade, and may affect its development in the future.

### **3 Factors Affecting the Growth of the Statistical Education Movement**

#### *3.1 Introduction*

There are, of course many sensible reasons why statistics should be taught within both schools and universities. Holmes (1980), Barnett (1983) and Råde (1985), in particular, have outlined these succinctly and convincingly. They include such points as the need to appreciate the uses of statistics in our daily environment; the role played by statistical reasoning in many disciplines as well as in business and industry; the help statistics can give in developing a feel for numbers, in the use and interpretation of graphs, and in providing familiarity with computers and calculators; the importance of statistical information in effective government and business decision making.

I shall take these matters largely for granted. They form, as it were, the statics of the problem, but I want to try and catch a glimpse of the dynamics, the educational and social currents that have been moving statistical education rapidly forward in the recent past. Major initiatives such as the Quantitative Literacy Project in the US, the Schools Council Project in Statistical Education in the UK (1957–81), the rise of “stochastics” in the German-speaking countries, as well as developments such as the ICOTS Conferences and the founding of the Journal “Teaching Statistics”, suggest that the movement is more than just a local or regional phenomenon.

In trying to identify the factors lying behind such changes, it would be wrong to underestimate the role of the ISI itself. Tracing the history of its education programme, one sees a major effort, sustained over a period of more than forty years, prosecuted by some of the most distinguished and perceptive statisticians of our times, to explain and publicise the need for statistical education. They have identified key problems, sought assistance and coordinated efforts in trying to resolve them. In the last decade, the ICOTS Conferences, in particular, have brought together teachers and educators fighting to promote statistical education in many different countries and different contexts, fostering personal contacts, assisting participants to gain confidence, and to develop a better perspective on the difficulties facing them, as well as picking up new ideas for their own teaching efforts.

One may sense, however, that the ISI’s initiatives have been themselves only a response to deeper currents. Many developments have arisen independently of any ISI initiative. Can one identify any of the deeper causes? In the rest of this section I shall put forward some tentative thoughts in this direction.

#### *3.2 A Slow Recovery From a Troubled Adolescence*

Few of the 17th, 18th or even early 19th century mathematicians who participated in the development of probability and statistics seem to have doubted the importance of their subject. The writings of Bernoulli, de Moivre, Laplace—to name only the most eminent—express a firm conviction of both the mathematical and the social importance of the subject they were treating. “Common sense reduced to numbers” was Laplace’s confident evaluation. Granted this initial confidence, why, in the 20th century, do we have such trouble in gaining acceptance for probability and statistics within the main stream of mathematical education? What went wrong?

Many writers have commented on the fact that at some stage during the middle of the 19th Century this initial confidence was lost, and probability and statistics found themselves relegated for a while to the mathematical backwaters. The reasons for this relegation have been interpreted in different ways by different writers. Gnedenko and Maistrov (see Maistrov (1974)) suggest that, following Laplace’s popularisation and mathematical elaborations of the subject, it became a victim of its own success. Followers of Laplace, less critical and less capable, applied it in situations where it was clearly inappropriate, bringing the whole field into disrepute. Stigler (1986) more cautiously suggests that the reasoning needed in applying statistical methods to social issues (in particular) was far more subtle and difficult than had first been realised, and required a considerable period of retrenchment

and reappraisal. Probability itself had to await the developments of 20th century analysis before it could be given an adequate mathematical basis. It was not until the early years of the 20th century, that the subject began to flourish again; now it bids fair to realise the potential envisaged by its early developers.

The important point for our purposes is that the backwater period for probability and statistics coincided with a crucially important period in the development of higher education. It was just during this period, the second half of the 19th century, that the traditions and the curriculum of the modern university began to take shape. In Britain, for example it was the time at which many of the important “red brick” universities were founded.

Inevitably, the pattern of university mathematics current at that time became somewhat frozen in the institutional setting, and was sustained from then on by a mathematical establishment that was hard to dislodge.

Unfortunately, the mathematical paradigms laid down at that time paid scant attention to probability and statistics. In Britain, these paradigms highlighted on the applied side the great 19th century developers of deterministic physics, such as Kelvin and Maxwell, while on the pure side, it emphasised the algebraic traditions characterised by mathematicians such as Cayley and Boole.

Changing these paradigms—that is to say, challenging the establishment—is no easy matter. Even so fine a mathematician as G.H. Hardy, seeking to bring belated recognition in England to the great development of analysis on the continent in the early decades of this century, found the establishment hard to budge. His classic text “Pure Mathematics”, was, he noted in a later edition, “written when analysis was neglected at Cambridge, and with an emphasis and enthusiasm which make it seem rather ridiculous now”. Probability and statistics had an even harder time in gaining recognition. However dramatic the development of statistics in the hands of Fisher and others, it was too far removed from either the applied or the pure traditions of British mathematics to meet with any sympathy from the mathematical establishment. It was only after the 2nd World War, when the subject proved its usefulness in the operations research arena, that the attitude of university mathematics departments began to thaw, and then only slowly. Since the universities dominated the entrance examinations, and these in turn dominated the school programmes, the schools had little opinion but to follow where the universities led.

The situation on the continent is much less familiar to me, but here also the end result seems to have been to place statistics, in particular, in an unfavourable educational position. My impression is that a major role in shaping the pattern of education on the continent was played by the Napoleonic reforms, which separated upper secondary and higher education into two basic streams, academic and technical. Statistics falls into the gap between the two streams. Probability in France found itself a respected niche in the academic stream as a branch of analysis, and flourished strongly there, and later in Russia, during the first half of this century. Within the technical stream, one can find leading groups of economic statisticians, engineering statisticians, medical statisticians, etc.—but not statisticians, as such. The school programme is therefore in something of a quandary: does statistics belong with the lycées or the polytechnics? With mathematics, or with the subjects that it serves? Analogous problems beset the introduction of statistics into school programmes in Italy and Germany, and in those countries, such as Russia, and later China and Japan, that were heavily influenced by the French and German university traditions. In all of these countries, statistical education is fighting not just the mathematical establishment, but basic structures of school and university organisation.

It would be an instructive exercise, I think, to contrast the development of statistical education in India and in Japan. Both countries have deep seated cultural and educational traditions of their own, and both were influenced deeply by the contact with Europe. However, Japan took Germany, and later the United States, as its principal models; while India was subject to the British yoke. Japan, when I visited it in 1976, had one established university statistics department. By contrast, India has for decades provided the West with a non-trivial proportion of its university statistical staff.

What elements in the amalgam of local traditions and foreign influence caused these remarkable differences? Was it the presence of a Mahalanobis in India, or differences in cultural and intellectual traditions?

I am surprised that such questions have figured little, if at all, in the ICOTS meetings. Yet they seem to me proper subjects of inquiry for an international association devoted to statistical education, for at least two reasons. The first is their intrinsic interest. John Bibby has emphasised, and I thoroughly endorse his point, that it is very important to look not only at the history of statistics, but also at the history of statistical education. It throws a different light on the struggles new concepts have had to gain acceptance, and the forces opposing them. The second reason is the importance of such studies to anyone engaged in the frustrating crusade of trying to change national school curricula. One needs to understand the forces opposing change, their cultural and political origins, before embarking on a campaign of reform.

Finally, I think it is important to realise that some of the present enthusiasm for statistical education gains strength from having been so long pent up. If change had been any easier, the need would be less strongly felt.

### *3.3 The Democratisation of Mathematics*

The main point I want to make in this section is that the importance of statistics education is not related solely to its specific content, but to the fact that it has become the flag-bearer for a more general reappraisal of the nature and function of the mathematics education programme. The energy of the movement derives partly from these deeper currents, and might be hard to explain without them.

I have not been able to find a better phrase for the nature of this more general process of transformation than the title of this subsection. I want to start from the thesis that in the past, and to some degree even up to the present, education has acted primarily as a social sieve. It was deliberately made difficult, sometimes in rather artificial ways, to indirectly consolidate the positions of influential families or to select a privileged class of bureaucrats. Mathematics has a long history in this social process. Like the classics, it entered into the medieval hierarchy of subjects, dominating those of the quadrivium. During the nineteenth century university students were mainly from privileged families. The pain (“intellectual discipline”) of mastering the basic concepts of Euclid was compensated by the prospect of a position of relative affluence and distinction at the end of it, affording ample leisure to reflect on the education he (almost always; “she” was the rare, rebellious, exception) had undertaken, to recognise its virtues in retrospect, and to recommend it to the younger generation.

Nothing like this comfortable outcome presents itself to our current mathematics students, whether at high school or in the early stages of university. Mathematical skills, in a modern environment, may be necessary for the task of finding a job, but they are far from sufficient. Moreover the aspects of mathematics which are most useful in this respect are linked to more directly practical concerns than those which informed the classical school programme. What does Euclid, or indeed proof in general, have to offer in this regard?

It would take a remarkably gifted and perceptive teacher to answer such a question persuasively, in the face of forty sceptical teenagers confronting him or her in the modern classroom.

One of the notable achievements of Western societies in the last few decades has been the extension of modern education, including mathematics, to a very substantial proportion of the population. It is no longer a relatively small, “academically” selected minority that proceed with their studies until age 18, or even to age 21, but a substantial majority. Moreover, in most Western countries, girls participate equally or to an even greater extent than boys in this process.

It is within this context that the movement for statistical education has taken root. Its motivations are quite different from those of classical mathematical education. It has never been considered as

part of a process of selecting the elite. It is as easily available to girls as it is to boys. It does not fit well into a competitive examination framework. On the contrary, a commonly expressed aim is to assist all students into the 21st century, by giving them a basic quantitative literacy in an age dominated by quantitative material.

It is in this sense that I see statistics as a key part of the more general process of the “democratisation of mathematics”.

A very special feature of statistics in this regard, which I have already mentioned, is that it breaks away from the vision of mathematics as a male-oriented subject. From the time of Florence Nightingale onwards, statistics has enjoyed the support of some very forceful and outspoken women—not least, perhaps, because it provided them with ammunition for their own campaigns. Traditional mathematics teaching formed part of an education programme which acted to perpetuate a tradition of male dominance. Statistics does not carry the same historical loading and can encourage girls to continue with mathematical subjects, reinforcing social and educational changes already at work in the schools. An example from my own experience relates to the introduction of a “Mathematics with Statistics Course” as an alternative carrying equal weight to a “Mathematics with Calculus” course in the final year of the New Zealand school programme (ages 17–18), this pair replacing an older split into “Pure Mathematics” and “Additional Mathematics”. Exact figures for the gender split are not available, but the total enrolment (one paper or the other or both) jumped sharply when the courses were introduced, and since most boys already took mathematics it is a fair presumption that the bulk of the increase was made up of girls. For a discussion of other issues encountered in the introduction of these courses, see Vere-Jones (1985).

Another illustration is the more favourable employment prospects for girls in statistics-related jobs. In several of the S.E. Asian countries, for example, it is quite common to see the majority of staff in government statistical offices being women. The immediate reason for this may not be flattering—statistical jobs are seen as having lower status (as compared with, say, economics or medicine) by men and are therefore left for the women—but it is firm evidence that statistical training provides a career route for women which admits them to interesting and responsible positions.

These points need emphasising also as a warning. Opposition to the introduction of statistics into the school programme may have deeper roots than mere inertia. The influence of cultural traditions, including even religious beliefs and practices, cannot be dismissed lightly. Such issues are controversial, and have been hardly touched upon up till now. Yet they must be born in mind in attempts to promote statistical education at school level within an international framework.

In such respects the current changes are to be contrasted with the earlier changes in mathematics education, during the 1950’s, and 1960’s, loosely labelled the “new mathematics”. The primary purpose of this movement, at least as I see it, was to blow apart the rigid framework of a school mathematics programme which had persisted with very little change since the middle of the 19th century. Primarily launched by the mathematicians themselves, it made no particular attempt to break away from the elitist tradition. Indeed, I associate it, among other matters, with developments such as the creation of special schools for gifted children and the “Mathematical Olympiads”, which were overtly elitist in character, albeit with an academic and scientific elite, rather than a bureaucratic and governing elite, primarily in view. It had to come first, however, to accommodate the deeper and no doubt slower changes implicit in a concept of mass education up to age 18.

### 3.4 *The Other Dimensions*

Both of the previous subsections considered statistical education as a component within the framework of mathematical education. If this were all, it would put an international association for statistical education on a par with, say, an association for geometrical education. However, from James Bernoulli’s unfinished chapters on the applications of his “art” to social and moral problems onwards,

probability and statistics have posed philosophical, social and procedural questions which give their study dimensions not present in other areas of applied mathematics. These hidden dimensions are also part of the story of statistical education, contributing, just as with James Bernoulli's famous theorem, both to its importance and to its difficulty. The democratisation and feminisation issues raised in the previous section are one of these hidden dimensions; here I wish to touch on three further points of this kind: the importance of statistics as a key methodological tool in areas such as the medical and social sciences; its importance in government and politics; and its ethical demands. While these may not be major factors contributing to the statistical education movement at present, they are still factors to be reckoned with, and in the long run they may turn out to be as important as the links with mathematics.

All of the ICOTS Conferences have had important contributions from teachers of statistics in disciplines outside the mathematical sciences. Their concerns deserve attention just as much as those of teachers of statistics within the mathematical sciences. One might single out the medical and social sciences because of the direct human importance of getting the statistical methodology right in applications such as clinical trials or social and economic surveys. From this point of view, it seems even more important to teach the doctors and social scientists to use statistics correctly than it does to teach the mathematicians. Statistical education cannot restrict itself to a vision of statistics simply as a branch of mathematics.

At school level, a more than trivial case can be put forward for taking the teaching of statistics right outside the mathematics programme, and placing it in courses in general science and social studies. Even at present, statistics creeps into the school programmes in biology, geography, even chemistry and physics, and leads to the question of who should try to coordinate its appearances across the school programme as a whole. For a UK proposal to tackle this problem see Mary Rouncefield's discussion of a "school statistical coordinator" (Rouncefield (1991)). Farrag (1991) and other contributors to the ICOTS 3 session on "Teaching statistics in non-mathematics courses" suggest that statistical education may be at its most useful and lively precisely outside the mathematics programme. Other ICOTS sessions reinforce the impression of vigorous and productive debate over methodological aspects of teaching statistics outside of the traditional mathematical context.

The political dimension of statistics originates in the work of government departments of statistics and the importance to democratic freedom of publicly available, accurate, statistical information. Regimes can perish for the lack of it, and honest statisticians can perish in the face of a hostile regime. Information is power, and government statistical offices are the official providers of that power. In Western countries statistical offices in recent years have been subjected to increasing political pressure, and in trying to resist it have played an important role in safeguarding some basic democratic principles.

Statistics can be used politically in other ways as well. Devaki Jain (1991) highlighted in her ICOTS plenary address the way that the reporting of statistical information can discriminate against particular social groups, especially women. Similarly the reporting procedures required by an organisation such as the International Monetary Fund can help to bind countries requesting support into a perpetually subservient role. Should considerations of this kind figure in statistics courses, or only in courses in political science?

Closely related to these aspects are the ethical ones confronting individual practising statisticians. It is hardly coincidence that the last decade has seen the drawing up of an international code of ethics for statisticians, and the development of professional statistical associations sharing features in common with professional associations of other groups, such as doctors and lawyers, who bear responsibility for actions and decisions which directly affect the welfare of individuals. It might be wrong to start an elementary statistics course with the discussion of such issues, but not as wrong as finishing the course without such issues every being mentioned.

Such considerations take us back to the early concerns of the ISI with the provision of statistical

cadre for government offices in the developing countries. The current bias of the statistical education movement is towards the concerns of the developed countries. Many of these must seem pedantic or irrelevant to the harsh realities of life in the developing countries. There is a responsibility, not easy but important, for the statistical education movement to acknowledge and respond to the problems of training statisticians and more generally of teaching statistics in the developing countries. The ISI had led the way in voicing concerns about these problems and trying to address them.

#### 4 Issues for the Future

In this final section I want to return to the newly formed IASE and to suggest some of the important issues, opportunities, challenges, and difficulties that it is likely to face in both the immediate and longer term future. Again this is a highly personal view, intended to try and capture some of the impressions which have built up during my association with the Education Committee and the IASE Interim Executive.

##### 4.1 *Future Viability of the IASE*

There is no doubt in my own mind that statistical education has a long and exciting future. The currents driving it are deep, and there is a solid, rational basis for its importance. The question the IASE will need to face is not so much whether statistical education will continue to be of interest in the years ahead, but whether or not the Association itself can continue to hold together. At first sight statistical education might seem a rather narrow topic, and one might question whether it even warranted an international association of its own. A closer look, however, reveals that just the opposite may be closer to the truth. The single theme "statistical education" has so many diverging facets that it is hard to conceive how it can all be contained within a single organisation. The last 50 years have seen statistical education grow from a narrow focus on training professional staff for government departments, to a movement which stretches downward into the primary and even the kindergarten programme, and outwards, through training for a wide range of academic and technical disciplines, to programmes of adult or community education. Is there a sufficient communality of interest to hold this wide range of activities together within a single organisation?

Inevitably the next few years will see the development of local and national associations for statistical education. The topics are already in place in many school curricula, and as teachers become more widely and actively involved in the practicalities of teaching statistics at school level, demands for service courses, support groups, newsletters etc. are likely to proliferate. Sooner or later such developments will lead to the growth of local associations, linking teachers at school level with teachers from tertiary level institutions, particularly those concerned with teacher training, and also with statisticians from the community at large.

This is surely a development that the IASE should try to foster. Although I feel that the IASE is not itself an appropriate vehicle for handling the day-to-day interests of large numbers of school teachers in any particular country, it should encourage and form links with local organisations, and provide opportunities for international meetings where teachers can compare experiences, and share new ideas. There may be scope for developing the concept of institutional membership to secure continuing contacts with teacher-training institutes, leading schools and university departments, and perhaps local associations themselves.

More problematical is whether a single organisation can continue to serve the needs of such an enormous range of teachers. I hope myself that the IASE will manage to maintain its diversity. A similar diversity has long been a feature of the parent organisation, the ISI. Of course it has its disadvantages as well as its advantages. Whatever the difficulties, I think it is very valuable to have at least one major international organisation which allows teachers in totally different teaching

environments to sit down and compare notes on teaching topics with a broadly related theme. Again this need not preclude the development of more specialised societies, at international as well as national level.

Another potentially divisive issue lies in the name. “Statistical Education” might be seen as a title rather closely aligned to the Anglo–Saxon world-view. There is an implicit relegation of probability to a more mathematical, peripheral role. Teachers from a German-speaking environment might find this difficult to accept. Even in English there has been some attempt to promote the use of the word “stochastics”, derived from the German usage, to describe the amalgam of probability and statistics needed at school level. Ephraim Fischbein, in extremely stimulating and provocative papers (see, for example, Fischbein (1987), (1989)), has emphatically asserted the primary role of probability ideas in guiding the development of statistical teaching. If the two aspects can hardly be separated, why is only one of them reflected in the Association’s title? Others, however, have argued hardly less forcibly for an emphasis in teaching statistics that barely mentions probability. The need for continuing evaluation of both these viewpoints is so important that it would be tragic if either group was alienated merely on account of the title.

A somewhat different issue arises at the primary school level, where one might question whether teaching the use of different graphical representations of simple data sets properly merits inclusion under the title of “statistical education”. It is true that statisticians have been the traditional guardians of such graphical procedures, but what is in view here is a shift in emphasis within the teaching of basic mathematical skills, rather than the introduction of a new subject. At least, the link with statistical education has brought new ideas and new approaches to the attention of primary level mathematics teachers and teacher-trainers. This is surely a development to be supported, and the IASE can help crucially in its initial stages. As the ideas become an accepted part of the primary curriculum, however, the IASE may seem too much of a specialist organisation to carry the main responsibility for pedagogical work in this area.

In sum, however, I feel that difficulties mentioned in this section will only test the strength of purpose of the new Association, and provide it with a chance to show its vigour and flexibility.

## 4.2 *Educational Inertia*

To be confident of a long term future is one thing; the speed of its arrival is something very different. One should never underestimate the *slowness* of educational change.

In preparing this article I was taken by the following passage:—

“It seems to me that one of the most inspiring signs of the times in education is the growing feeling—and the attempt to realise it—that when he passes under the school door, a child shall not feel as if entering into an unsympathetic, foreign world, where all is mysterious and artificial, out of which he passes periodically, with dazed ideas, only too glad to find himself once again amidst the familiar and the intelligible. We would have him, on the contrary, bring with him his outside ideas of the real world into our classroom, there to be explained and developed, thus forming a firm basis on which to build the superstructure which is to increase his understanding of that world outside the schoolroom—*the world, par excellence.*”

This is not, as one might guess, from a recent advocate of statistical education and child-based learning, but from a study of mathematical education written by a Divisional Inspector of the London County Council in 1908 (Branchford (1908)). The moral is that even changes which seem imminent may take decades, if not longer, to eventuate. And in the case of statistical education it would be optimistic, in a significant number of Western countries, to feel that changes were imminent. In seeking to promote the introduction of statistics into school programmes, the Association must anticipate a long, dour struggle. What are its ingredients likely to be?

The first relates to the teachers themselves, not because they are unwilling to contemplate change

(a few may be, but in my experience they are a minority) but out of fear of a lack of support to help them through the changes. The majority of secondary school mathematics teachers presently teaching are not likely to have studied statistics as students. How can they teach this new topic, especially if it involves new approaches, without being given the time and teaching resources to overcome their deficiencies?

There is, therefore, a substantial teacher in-service training problem, without which teachers will not be enthusiastic to embrace change. Some interesting cooperative strategies are being devised within the Quantitative Literacy project (e.g. Burrill (1987), (1991)) in the US, but the school scene there is so complex and decentralised that the task of implementing a nationwide change is a daunting one indeed.

A second problem is in the role played by the teacher training institutions. If they resolutely and emphatically embraced statistics teaching then at least the next generation of teachers would be adequately prepared, but they themselves are constrained by the requirements of the current syllabus. Their first responsibility is to train teachers for the tasks immediately in front of them. They, too, require some guarantee of commitment to the changes before they can adopt them. In some cases they have the same diffidence as the teachers about teaching a new subject. Granted the absence of significant funding, which seems too much to hope for in the present day and age, the moral is that both the teachers and the teacher-training institutions need to be assisted by the statistical community at large. This could be a very important role for statistical education organisations, particularly ones with links to the wider statistical community. They can help with putting on familiarisation courses, providing teaching materials, assisting in the running of seminars and in-service courses, giving teachers moral support in keeping pressure on the education system. The IASE should move into a position to provide help, suggestions and contacts for local organisations trying to develop this kind of role.

Finally there is the aspect of formal curriculum development. The specialists in curriculum development may be sympathetic to change, but often a new curriculum cannot be implemented unless there are concurrent changes to prestigious state or university entrance examinations. Such examinations can form a major barrier to change, particularly if the prescriptions in mathematics are under the control of traditional mathematics departments which are unsympathetic to the cause of statistics. I would be happy if my concerns at this point were anachronistic, a memory of battles now largely won, but I do not believe that this is the case, even in the West. It is especially a problem in the developing countries, where entry to university is still controlled by highly competitive entrance examinations.

Nor should one be too easily reassured by the success of small groups of enthusiastic teachers teaching outside the main syllabus or in specially favoured circumstances. The essence of the task is to develop programmes that will be accepted and successful in the mass of schools. This is an enormously daunting task, whether one is looking at a society with a highly centralised system, or one, as in the United States, where there is a great deal of local autonomy in regard to curriculum development. If anything, it may prove easier to change a system of the former type than of the latter. To achieve a goal of this kind, the patience and determination of organisations working to achieve change will be tested to the full.

### 4.3 *Statistics Teaching in Universities and Technical Institutes*

I find it singularly difficult to comment on this topic, whether from excessive familiarity or the painful evidence of my inability to master it, I am unclear.

One conviction is of the stability of the basic impulse driving the ICOTS Conferences. It has been, and is likely to remain, the desire of teachers at all levels to compare their experiences and difficulties, and to pick up new ideas for innovation and improvement. University teachers are no exception to this

rule, but have the advantage (at least for the present) of greater opportunities to attend conferences than their counterparts at primary or secondary level. In increasing numbers they are being joined at ICOTS Conferences by teachers in medical, engineering, and other more specialised institutes, whose staff have the responsibility of imparting a basic understanding of statistical principles to students across a wide range of professional and vocational subjects. Together, they are likely to continue to form the core support group for IASE and the ICOTS Conferences.

There is no shortage of immediate teaching issues across this wide range of participants, although I do not get the impression, as I do at school level, of involvement with a major reform of the teaching programme. It is rather a problem of tackling, within a variety of contexts, some very hard pedagogical questions. At the heart of these is the stubborn fact that the successful application of statistics involves a difficult combination of mathematical and non-mathematical skills. On either side of the statistical fairway lie two deep bunkers, one for courses which are too mathematical, and the other for courses which are not mathematical enough. All of this is to say nothing of the specific problem, hard enough for experts, of grasping the subtle effects of variability, the unexpected order that can be extracted from the proper understanding of disorder. How to impart such subtle insights is a challenging problem in the most favourable circumstances; to attempt it in front of an audience of three hundred reluctant students, with no more assistance than a lectern, a blackboard and an overhead projector, would challenge a Houdini. As a consequence, I see no shortage of contributed papers for many ICOTS Conferences to come.

The question of statistics teaching at university level raises what seems to me a key issue for the future direction of the IASE. Does it see itself as primarily a professional or a research organisation? Is its main purpose to provide a meeting ground for professional teachers of statistics, or to advance statistical education as a scholarly discipline in its own right?

I do not think it takes too much reflection to come to the view that of these two choices, it is the professional role that the Association was primarily set up to fulfil. Statistical education as a discipline is (to me personally) the more intriguing concept. It has provided some of the most important papers at ICOTS meetings and elsewhere. It gets to grips with the fundamental question of why it is so hard to teach probability and statistics. But however much we may enjoy being engaged by fundamental issues of this kind, there are only a handful among us who could claim to be working systematically within the area of research into statistical education as such. Most of us are teachers, struggling to do a reasonable job within a profession that itself has only just “come of age” and in many ways is still struggling to define its own role and status. If this interpretation of the membership is correct, then the question for IASE is how best to support, within the general flow of its activities, the special and crucially important group who do devote themselves to the scientific and scholarly study of statistical education. Some of the Round-Table Conferences have come close to providing a forum for such work, and those concerned have started to develop informal networks, but there is still a long way to go, not least in resolving the questions of where in the university system such research is best carried out, and how it can be funded.

There is, finally, a third element in the ISI Education Programme, which is covered by neither of the alternative roles I suggested above for IASE. This is the sense in which the old Education Committee was set up to act as the educational arm of the whole ISI. It was not a group seeking to serve the interests of its own members, whether professional or scientific, but a group elected by a much larger community, including government, industrial and academic statisticians, to consider, take action on, and report back on, educational issues arising right across the statistical community. Whether the IASE becomes primarily a professional group, representing the interests of statistics teachers, or a research organisation promoting research into statistical education, it will move away from this role of representing the wider statistical community in educational matters, of acting as its ginger group (the “gadfly” role) in such matters. I do not believe that this issue has yet been clearly thought through, either by the ISI itself, or the IASE, but I feel that it merits serious consideration.

It implies a rather special role of the IASE in responding to educational concerns arising in other ISI sections, or in the core ISI membership. Its stewardship of the UNESCO funding for the ISI education programme, if this funding can be sustained, is an important illustration of the sort of responsibility this role entails.

#### 4.4 *The Developing Countries*

I have deliberately left until last the issue which I believe the IASE will have the greatest difficulty in tackling effectively. This is the problem of statistical education in the developing countries.

On the one hand this takes us back to the original goal of the ISI Education Programme, that of increasing the numbers of statistical staff within the developing countries. Despite the efforts of the ISI and other UN bodies this is a goal which persistently eludes achievement. Writing in 1964, Goudswaard noted that "there is still a shortage of statisticians in many countries and especially in the emerging countries the shortage is still acute". He acknowledged that since the start of the ISI Education Programme there had been a considerable increase in the number of training institutes but suggested that the demand still greatly outstripped the supply. He quoted a UN Memorandum (1959) to the effect that, in regard to statistical work, "by far the most important problem facing most countries is that of assuring an adequate supply of trained statisticians at both the intermediate and higher levels".

Writing about the problems of training statisticians in Africa for the ICOTS 3 Meeting in 1990, Tulya-Muhika (1991) took an even more pessimistic view. Referring to efforts to tackle this problem in the 1960's and 1970's he stated "Towards the end of the 1970's, the UNECA carried out an evaluation of the African Statistical Training programme only to discover that not only had the needs spectra increased and diversified since the 1960's, but the training programmes in place had not even met the original quota (neither for professional-level nor for middle-level training)". He was equally pessimistic about the outcome of the Statistics Training Programme for Africa initiated in 1978, noting that it had failed to meet its objectives of making Africa self-sufficient in training statisticians by 1990, and predicting that its assessments of needs would turn out to be underestimates because of the high rate of staff "leakage", and the fact that many African countries still did not have nationally integrated statistical services from which their needs could be properly assessed. In particular, there is an inevitable tendency, as local statistical staff became more highly trained and experienced, for them either to emigrate to the developed countries, or, if they remain in their home countries, to be elevated rapidly to senior administrative or political positions in which their technical skills are effectively lost.

The problem for ISI, and for IASE in particular, is that the thrust of its education programme in recent years has been in different directions. According to the analysis in Section 3, the major events leading to the formation of IASE have their roots in developments in the West. Efforts to maintain the ISI's involvement in the statistical training programme for developing countries have had a somewhat token character. This is not to deny the personal efforts of members of the Education Committee, but to underscore the great difficulty that the ISI itself faces in trying to be of assistance. There may, in fact, be very little that the international community of statisticians can actually do about the problems. There is a danger that at best their efforts will remain peripheral to the hard core of the problem while at worst they may hinder the development of more effective, locally based solutions.

I do not wish to advocate such a defeatist view, but there is no point in trying to minimise the problems. Moreover it is not clear to me that, even within the ISI itself, IASE is the most appropriate body to address these issues. The training of statistical staff for developing countries is a theme which involves other sections of ISI as well as the IASE. The ISI might wish to develop an overall strategy for this problem which would identify appropriate roles for the different sections and

develop a coordinated approach. It may, for example, be better for the IASE to concentrate initially on consolidating the services it can offer to school and university statistics teachers in Western countries and in those Asian and other countries which have approached or are rapidly approaching the West in educational achievement. There is much scope for action in this field alone. My personal hope, however, is that the IASE will see itself as inheriting the responsibility laid on the old Education Committee to take the initiative on behalf of the ISI as a whole, developing links as appropriate not only with other sections of ISI but also with key UN agencies, and retaining or developing a special relationship with the international training centres.

All of this is to say nothing of the still more difficult problem of developing statistical education in schools in developing countries. Here it might seem that the question of curriculum content would pale into insignificance beside the greater problem of reaching the mass of the population with a basic education programme, or with even more basic needs such as food and clothing. Nasim Ahmad in his talk on Statistical Education in Gambia (Ahmad (1991)) observed that one school text book might cost as much as one month's food for the family, underlining at one stroke both the difficulties children from ordinary families face in getting into secondary education, and the kind of sacrifices that such a family might have to make to keep their child at school. In similar and worse circumstances it may seem impertinent to insist on the niceties of statistics versus trigonometry, for example. But this is not an excuse for withdrawal. It is even more important, in such circumstances, that educational effort is directed in an effective and relevant manner. Another point made by Ahmad is that in a society where secondary education is a distinction akin to an honours degree in England, recruitment into government is likely to take place directly from secondary school. There is then an even greater need than in the West to keep school mathematics practical and relevant. For example the arguments in favour of teaching rudimentary aspects of data analysis at primary level seem just as cogent in developing countries as outside them, if not more so. Unfortunately it is just the reverse tendency which is often seen. Education, even at secondary level, may assume a mandarin character which enables the educated echelon in that society to retain its position of privilege. Once again mathematics is cast in the role of a barrier to entry to higher studies, preserving education for the elite. Education for the masses, even if feasible, may not be what is really wanted by the groups in power. Even in so technical a field as mathematics, the curriculum is dependent on social and political structures and cannot be altered independently of these. Recognising such difficulties does not necessarily mean surrendering to them, but rather adopting strategies which take them into account and do not seek to achieve impossible tasks with limited funds. Steps towards the solution lie in providing local teachers with experience, teaching materials, information on what can be attempted, successful examples of how difficulties can be tackled and overcome. Getting to speak directly to teachers and to teacher trainers, avoiding the educational bureaucracy where this acts as a political barrier, may be important. In the least developed countries, there may be merit in schemes such as that suggested recently by Nasim Ahmad, whereby international agencies provide background funding for basic texts that can be printed locally, reducing costs further by adding some local content instead of requiring a complete new version for each country. In particular, such schemes may be of assistance for countries sharing a common language grouping, or able to use an international language, such as English, French, or Arabic, for the core text and material.

Although it is difficult to see how the international statistical community, operating through organisations such as the IASE, with limited financial resources and scattered membership, can deal directly with such issues, the past history of the Education Committee provides some grounds for optimism. Over an extended period, its ability to identify key issues at crucial times, to speak on those issues objectively and with authority, and to provide seed funding for new initiatives has accomplished more than a little. It is this role which I hope that the IASE can develop and continue.

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## **Résumé**

On donne un aperçu des faits nouveaux dans le domaine de l'enseignement statistique pendant la période qui précède la formation de l'*Association for Statistical Education* (IASE) en 1991 et on tente d'entrevoir l'avenir. La première section fait l'historique du comité de l'enseignement statistique de cette association, depuis sa création en 1948 jusqu'à celle de l'association en 1991. La deuxième tente cerner certains des facteurs importants qui expliquent l'intérêt de plus en plus marqué qu'on porte à l'enseignement statistique au cours des deux dernières décennies. La troisième expose un point de vue personnel sur certains problèmes que l'association devra résoudre dès les premières années de son existence.

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