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The Role of ISI in the Field of Statistical Education: 1949–1979

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1 Introduction

The ISI was established in 1885 as an international society for the development and application of statistical methods. The Institute, originally composed largely of official statisticians, has since grown to a size of more than 1000 members from over 80 countries; it has become increasingly diversified in its membership, particularly with the formation of sections. There are now four of these: the Bernoulli Society for Mathematical Statistics and Probability (formerly the International Association for Statistics in the Physical Sciences), the International Association of Survey Statisticians, the International Association for Regional and Urban Statistics, and the International Association for Statistical Computation. In addition, approximately ten international and 20 national statistical societies are affiliated with the ISI; this establishes the Institute as the foremost international statistical body, with responsibilities in the scholarly, communications, program management, political and educational areas of statistics.

Examples of ISI's numerous functions include:

1. The promotion of research and professional practice through learned articles in its *Review*, and papers presented at its various Conferences and Symposia.
2. The creation in 1959, and the regular maintenance of the *Statistical Theory and Method Abstracts*, to provide a comprehensive abstracting service and encourage the continuing education of professional statisticians.
3. Closer communication and collaboration between official, applied and theoretical statisticians through its biennial *Sessions*, the *Proceedings* of which are regularly published in the *Bulletin of the ISI*.
4. The management of international projects of recognized social importance such as the World Fertility Survey.
5. The fostering of modern statistical organization and procedure in developing countries through such institutions as the International Statistical Training Centres.
6. The sponsorship of statistical education through its Education Committee.

Even these represent only a small part of its involvements in the arena of statistics; it is essentially the last two topics, 5 and 6, which I propose to discuss here.

2 Past educational programmes of the ISI

The ISI became involved in statistical education in a systematic manner after World War 2. Education was considered to be a promising area in which ISI could make a contribution to the solution of social and economic problems of countries, both developing and developed. In 1949, a resolution was passed in the UN urging 'the UNESCO and the ISI to take appropriate

steps to further the improvement of education in statistics on an international scale'. This led in the same year to the establishment of the ISI Committee on Statistical Education, which celebrates its 30th anniversary in 1979. The work of the Committee has been reviewed by Nixon (1960) and Goudswaard (1964) and more recently reappraised by Zarkovich (1976). Thus a brief account of the achievements of the ISI in statistical education over the past 30 years is perhaps in order. These can best be summarized under the general headings of Educational information and communication, Training centres, Teaching aids and techniques, and Training methods and curricula.

2.1 *Educational information and communication*

Anyone looking through copies of the *Review* will have noted its sections on Statistical Training and Research, and on Statistical Societies. If for example, one browses through Volume 37 for 1969, then under the first section, one may find accounts of the OECD Symposium on the use of statistical methods in the analyses of road accidents held on 14–16 April, 1969 in the UK Road Research Laboratory at Crowthorne, Berkshire. There are also details of the activities of over 20 Statistical Institutes, Centres, Departments and Laboratories throughout the world. Under the second section, summaries of the proceedings of over 20 Statistical Societies from the ISI itself and the Biometric Society, to the Czechoslovak Demographic Society and the Société de Statistique Yougoslave, are provided.

The *Review* has a wide and influential readership; from these accounts, statisticians throughout the world are made aware of a variety of educational problems. Among these are the need to train traffic engineers and road authorities on the applications of statistics to road research, the rapid spread of electronic computing methods in statistics to the Arab countries during 1969, and the need for a sample survey on cooperation between industrial concerns in Yugoslavia.

One should also mention Round Table Discussions and other meetings devoted to educational problems. One such, the 'Round-Table Discussion on the University Teaching of Statistics in Developing Countries' held between 26–29 August 1968 in The Hague, is also reported in Volume 37 (1969). This considered such themes as the teaching of statistics for use in developing countries, principles for the development of statistical teaching in Universities in developing countries, University training in the application of statistics to socio-economic planning and policy, and other topics such as the problems of textbooks and libraries.

Another such of outstanding importance was the Third Round-Table Conference on 'Statistics at the school level' held in Vienna between 30 August–4 September 1973, which resulted in the book of the same title edited by L. Råde (1975). This conference discussed a variety of topics ranging from official statistics to the teaching of probability and statistics at the secondary school level. Recommendations were made on the creation of new materials, teacher training, conferences and surveys. This has been followed up by a Fourth Conference of the same title held in Warsaw between 29–31 August 1975, of which the Proceedings have been edited by Breny (1977).

These considerable contributions to statistical education rely on the spread of information to fellow professionals, and are directed at the improvement of existing statistical methods, or the solution of social and economic problems involving such methods.

2.2 *Training centres*

ISI recognizes a selected number of statistical institutions as International Statistical Training Centres; it has assisted in the establishment and support of several of these. Two in particular, one in Beirut and the other in Calcutta have been established and operated with financial support from UNESCO, the Ford Foundation and several governments. ISI also administers

a Middle East Fellowship Fund which provides study grants to students from Arab countries.

Directors of the Training Centres have been in regular communication; they have met on occasion to discuss problems of training and organization, for example at Szentendre, Hungary in 1973, and at The Hague in 1976. Their next meeting has been scheduled for May 1979 in Rabat, Morocco.

It is well recognized that effective collection and analysis of statistical data lies at the basis of efficient administration. While developed countries are relatively fortunate in the number of trained statisticians at their service, developing countries suffer from a shortage of trained personnel. They lack such supporting staff and equipment as are necessary to conduct sample surveys, or to carry out complex demographic or economic computations.

By its support and coordination of the Training Centres, the ISI has made a major contribution to the problem of statistical organization in the developing countries.

2.3 *Teaching aids and methods*

Teaching aids have traditionally included such items as statistical dictionaries, statistical bibliographies, and the use of computers in statistical consulting and research. In each of these areas, ISI has been active; M.G. Kendall's and W.R. Buckland's 'A Dictionary of Statistical Terms' is well known. Our illustrative Volume 37 (1969) of the *Review* contains one of H.O. Lancaster's 'Bibliography of statistical bibliographies: a second list', a continuing opus of which the author has just produced the eleventh part in Volume 46 (1978). There is also an account of the USSR's efforts to design a uniform state network of computing centres to promote the introduction of new computing techniques in economics.

So far as teaching methods are concerned, these were reviewed extensively at the 1970 Oisterwijk Round Table Conference; an outline of the proceedings is given in Section 2.4. ISI has also cooperated with UNESCO in carrying out a 'Survey on the Teaching of Statistics for Developing Countries' in 1973; by this and other efforts, ISI has participated actively in developments in the area of teaching aids and methods.

2.4 *Training methods and curricula*

A central concern of statistics teachers at schools and Universities is curricula, and the optimal method of training statisticians for specialized expert functions. One of the current debates in Australia is centred on the lack of suitable training for statisticians entering government service; strange though it may seem, the Australian Bureau of Statistics is not entirely satisfied that Australian universities provide the correct mix of demography, statistical methods and computational skills necessary for government statisticians.

Other countries have analogous problems: it is thus inevitable that statistical curricula both at school and at university, which are clearly of great importance, should be subject to constant criticism. ISI has sponsored several conferences at which such programmes have been considered, and there has been much written in the *Review* on these topics.

Between 9–12 September 1970, a Round Table Conference on New Techniques of Statistical Teaching was held at Oisterwijk, The Netherlands; this considered new training methods and detailed curricula for various courses in statistics. The proceedings were reported in Volume 39 of the *Review* for 1971; to give the flavour of the many topics discussed, a few articles are quoted. These included: K. Anstwick's, J. Hine's and G.B. Wetherill's 'The first course in statistical methods and the use of teaching aids', W.J. Dixon's 'Notes on available materials to support computer based statistical teaching', H.C. Hamaker's 'New techniques of statistical teaching', and J. Hemelrijk's 'Comments about a general audience TV course on statistics'. F. Mosteller, the Conference Chairman, outlined the work of 'The joint American Statistical Association – National Council of Teachers of Mathematics Committee on the curriculum in

statistics and probability', while D. Quade presented the 'Development of materials and techniques for the instructional use of computers in statistics courses', and J. Stuart Hunter reviewed 'Post college continuing education activities in statistics'. The discussions were broad-ranging and thorough, as readers of the proceedings will have noted.

There is little doubt that the ISI has endeavoured, with considerable success, to think ahead about training and curricula in the statistical field since 1949. But inevitably, it cannot do everything; its very international structure means that members of the ISI Education Committee from widely distant countries are unable to meet often, and are perhaps too dispersed for prompt joint action. There have been criticisms, all of them valuable, and it is these which I shall now review.

3 Criticisms and suggestions

It is a fact of life that whatever may have been achieved by a Committee, it is never quite enough. Interpreted in the most constructive terms, this means that the ISI Education Committee must constantly review its objectives to ensure that they are in accord with current social, economic and statistical developments.

Dr S.S. Zarkovich, a respected analyst and critic of ISI activities, has urged in his 1976 'Reappraisal' that work on certain areas of statistical education should be continued and strengthened by the ISI Education Committee. His main suggestions can be summarized as follows:

(*a*) *Teaching Aids*
Review papers are important in keeping teachers and students up to date. Several such papers should be commissioned and later reproduced for distribution to universities, particularly in the poorer countries.

(*b*) *Curricula for middle level schools*
An ISI curriculum and a related textbook should be produced to introduce Statistics to schoolchildren at an early stage in their education.

(*c*) *Textbooks for elementary statistics courses at university*
Existing textbooks are, on the whole, unsatisfactory. Books containing a judicious mixture of theory and real life applications should be produced. An international meeting might be devoted to this topic.

(*d*) *University curricula*
Curricula for one-year, and two-year courses associated with a major in another field, as well as a complete course with a statistics major should be developed as guides for teachers in new universities.

(*e*) *Guiding teachers of statistics*
To disseminate information on new ideas and results in statistical education, a bulletin under the name of *Statistical Education* should be issued from time to time.

(*f*) *Round table discussions*
These are to be encouraged, with more opportunity provided for participants to take part in informal discussions, and to write in for advice on their problems.

(*g*) *Educational consultations*
A standing advisory service on educational matters should be organized. This might be done on a volunteer basis in cooperation with UNESCO.

(*h*) *Educational cooperative arrangements*
Universities within easy distance of each other should be encouraged to cooperate in rationalizing statistical courses, so as to offer broader curricula and share staff.

(*i*) *Special educational topics*
There are statistical topics (e.g. census methods, industrial statistics) not covered by standard university curricula. Efforts should be made to ensure that such special topics are included in at least some educational centres.

(*j*) *Statistical Institutes*
Action should be taken in such Institutes to utilize research programmes for educational purposes, to encourage collaboration between staff in different establishments, to set up cooperative research programmes, and to arrange for specialized education on certain topics in each of them.

This is undoubtedly an ambitious programme, but remarkably, one which has already been met in several respects by the ISI Education Committee since 1976. It would perhaps be appropriate here for the committee to acknowledge Dr Zarkovich's stimulating views.

The matter of Teaching Aids is one which requires further detailed consideration; there is a feeling that dictionaries and bibliographies may have limited usefulness, particularly in the developing countries. Likewise, the spread of electronic computers and hand calculators may be of little relevance in the poorer parts of the world. The review papers suggested by Dr Zarkovich would certainly help teachers and students to remain informed of new statistical developments. For example, the work of Harry Posten in the *American Statistician* on audio-visual aids in statistics, could well be reproduced for wider distribution. Also elementary textbooks for schools and universtities, particularly written with the underdeveloped countries in mind, might also prove useful. It is possible that a start can be made by translating suitable texts from the English, now that several of these are available.

Dictionaries, bibliographies, statistical packages, information on computing equipment and data processing methods will remain of interest to statisticians in the more advanced countries. For developing nations, expository material on censuses, the collection of statistical data, the methods of sampling, and elementary data processing might prove more relevant. Much of this material would try to explain to managers and government officials what statistics can do for them. And perhaps most important of all would be the use of teachers as teaching aids; could Dr Zarkovich's excellent suggestion on Educational Consultations not include the formation of a volunteer body of expert international lecturers, willing to visit developing countries to advise on statistical methods and organization, or the setting up of relevant training courses? These are a few suggestions, which the Advisory Task Force on Statistical Education, newly formed in The Hague on 22–23 January 1979 (superseding and including the Task Force on Teaching Aids) is currently developing in some detail.

So far as curricula for middle level schools, and guiding teachers of statistics are concerned, I feel that the Task Force on Teaching of Statistics at School Level has these well in hand. The recently launched magazine *Teaching Statistics*, jointly sponsored by the ISI, the Applied Probability Trust, the Institute of Statisticians and the Royal Statistical Society, is concerned with both functions, and fulfils the role of the bulletin suggested by Dr Zarkovich. In addition, the Task Force intends to consider a broader range of problems in its deliberations. It would, however, be true to say that efforts have so far been directed mainly to developments in the more advanced countries, particularly the English-speaking ones. *Teaching Statistics* could perhaps be translated into Arabic, Chinese, French, Russian and Spanish, for use by teachers and pupils in other parts of the world. The growth of similar publishing ventures in the developing countries might well be encouraged. Experienced schoolteachers of statistics could also form a volunteer body of advisers, ready to travel to developing countries to help them with school curriculum and other teaching problems.

The matter of university textbooks and curricula would seem to lie roughly in the province of the Task Force on International Conferences on Statistical Education, which has already had

considerable success in these areas. Since Mosteller and his colleagues, as well as Freedman *et al.* (1978) have produced their recent expository texts, which include a wealth of practical examples, I do not believe that Dr Zarkovich's pessimistic view of elementary statistical texts is entirely justified. Shortly, textbooks will also be published from the UK Schools Council Project on Statistical Education; these carefully tested works are expected to become available in 1980. But with both books and curricula, it is unlikely that a single model will fit every circumstance. Books must be written in response to specific needs, and curricula developed to answer certain training requirements; thus, while general encouragement and guidance can be given by the Task Force, it is unlikely that a single book or curriculum will ever satisfy the diverse needs of different countries, or their universities.

In statistical education, we have tended quite naturally to concentrate on school and university education, and that in rather specific areas. Perhaps there is a need for a change of emphasis: should we not devote more time to educating managers, government officials, and politicians in the uses of statistics? Should the specific areas of education not be broadened to include economic, demographic, actuarial and sampling statistics, and should we not provide more information on the data collection, processing and computational methods of our subject? We need a more accurate evaluation of the level and type of statistics required in different countries, and of the comparative needs of advanced and developing countries in the area of statistical education. The Advisory Task Force on Statistical Education proposes to study the formation of an Advisory Educational Group of Volunteers ready to travel and consult on these matters in any part of the world.

It is clear that Dr Zarkovich approves of Round Table discussions; the modifications he suggests to them are minor and could certainly be incorporated in any forthcoming ones. He supports educational cooperative arrangements; his intention is splendid, but if he had witnessed the difficulties of setting up so straightforward a cooperative arrangement as the Manchester-Sheffield School of Probability and Statistics in England in 1967, he would recognize the intractability of such schemes short of compulsion or overwhelming necessity. Nevertheless, cooperation in and rationalization of statistical courses, however modest, should be encouraged wherever possible.

The final proposals on special educational topics and Statistical Institutes could well be regarded as the province of the Task Force on Coordination of International Statistical Training Centres. Most universities have never willingly included in their syllabuses topics of direct professional use. Census methods, industrial statistics, sampling methods, data processing can certainly form part of a university curriculum, but it is only their basic principles which are likely to be treated, and these briefly. Training Centres can devote more time to such topics, and to their practical details; I would go as far as to suggest that all students of statistics at universities should supplement their courses by attending Training Centres for practical training. The Co-op program at the University of Waterloo has effectively developed a similar scheme for student training. As to using their research programmes for educational purposes, I feel certain that every effort is being made by the Institutes and Centres to do so. There have been criticisms of the effectiveness of some Centres, and one might well consider forming an Advisory Inspectorate to visit, monitor and consult on the organization and work of a selection of Centres each year.

4 New directives

It seems clear to me that the four reorganized Task Forces of the ISI Education Committee as at January 1979, namely

The Task Force on the Teaching of Statistics at the School Level (*Chairman*, V.D. Barnett),
The Task Force on International Conferences on Statistical Education (*Chairman*, L. Råde),

The Advisory Task Force on Statistical Education (*Chairman*, R. Bradley),
The Task Force on Coordination of Statistical Training Centres (*Chairman*, M. Benyaklef),

are well fitted to carry out the basic educational programmes already outlined, including those modifications, extensions and innovations suggested by Dr Zarkovich, among others. What is not so apparent is that the problems of statistical education are adequately defined within our present framework.

The ISI in a recent soul-searching exercise has set up Committees on the Integration of Statistics (*Chairman*, J. Durbin), and on Future Directions (*Chairman*, J. W. Duncan). The Committee on Integration has urged that the *ISI Review* contain a section in which developing countries can present their statistical development problems for solution and assistance by statisticians in developed countries. It has suggested the formation of a standing advisory committee to provide assistance, on call, to developing countries. These directions have now been implemented by the recent formation of the Advisory Task Force on Statistical Education. The Committee has further recommended that integration be a major ISI focus, and that the ISI Education Committee address itself to this problem. Their view is that there are gaps between theoretical statisticians, users of statistical methods, specialists in different applied fields, government statisticians, and statisticians in developed and developing countries. They believe that one of the keys to this problem is statistical education and training, and it is for this reason that they have drawn our attention to it. The Committee on Future Directions has also indicated its interest in our current activities on education and training.

As I understand their suggestions, they would like to:

(*a*) Encourage the more developed countries to assist in the statistical education and organization of developing ones.

(*b*) Urge theoretical, practical, government and other statisticians to communicate more readily with each other, and in effect educate each other.

(*c*) Support expert and experienced statisticians in efforts to raise the standards of statistical work wherever this may be needed.

(*d*) Coordinate the activities of and information from national and international statistical societies.

(*e*) Ensure that practical and applied work form a part of the training of all statisticians; this has special relevance to university statistics curricula, and to the possible apprenticing of all statistical trainees in Institutes and Centres where applied work is carried out.

While these new directives are stated in somewhat different terms from the established aims of the ISI Committee on Statistical Education, closer scrutiny reveals their similarity to these earlier goals. Their emphasis is perhaps a little different, as is entirely appropriate in the changing conditions of statistics and statisticians in the modern world. But at a more fundamental level, there is little that is radical in the recent suggestions; they only confirm that we must persevere with our existing plans, and extend them to meet new challenges.

In view of the call to create an Advisory Statistical Education Service, the ISI Education Committee has broadened the responsibilities of the Task Force on Teaching Aids, renaming it Advisory Task Force on Statistical Education in January 1979, and charging it with the responsibility for:

1. Disseminating information on statistical education and providing a clearing house for enquiries on this topic.
2. Developing a program of Queries and Answers (possibly in the *ISI Newsletter*) dealing with issues of statistical methods, systems and organization.

3. Assisting in the arrangement of statistical consulting on education through consultants, site visit teams and advisers in response to requests; this would include help with text translation, as well as volunteer statistical lecturers, teachers and advisers of all kinds.
4. Publicizing its procedures for advising on statistical education.

It is my conviction that, with the solid basis of achievement already behind the ISI Education Committee, and with the imaginative development of the initiatives suggested by Dr Zarkovich, the Committees on Integration and on Future Directions and others, our four Task Forces are ready to make an appreciable educational contribution to what, in old-fashioned terms, were referred to as the health, wealth and happiness of mankind.

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