

INDIAN STATISTICAL INSTITUTE

FIRST CONVOCATION : 12 FEBRUARY, 1962

REVIEW

By

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THE FIRST CONVOCATION

The Council of the Institute decided to mark this occasion of the first Convocation of the Indian Statistical Institute by the award of the degree of honorary Doctor of Science to five eminent persons who have made great contributions, each in his own way, to the advancement of statistics.¹ It is a great honour that they have kindly agreed to be associated with the Institute by accepting these degrees.

In addition, the degree of Master of Statistics would be awarded to seven students and the degree of Doctor of Philosophy to two students on the merit of their advanced studies and research. We wish them all success in life and in their professional work.

REVIEW OF EDUCATIONAL ACTIVITIES : EARLY HISTORY

On this occasion it would be of interest to review the development of educational activities of the Institute. It would be recalled that at a meeting held in Calcutta on 17 December 1931 it was decided to establish a society for the advancement of statistics. A little earlier, during informal discussions, K. B. Madhava had suggested provision being made for training and education. This was included in the aims and objects of the Indian Statistical Institute which was registered as a non-profit distributing society under Act XXI of 1860 in April 1932.

Advanced studies and research in statistics had however started much earlier; and a small group of statistical workers had gathered, in an informal way, in what came to be known as the Statistical Laboratory in the decade before the formal foundation of the Institute itself which used to be located in, but was not a part of, the Presidency College, Calcutta. A tradition of research with an orientation towards the application of statistical methods to practical problems had been already established. During this period, Harish Chandra Sinha and Subhendu Sekhar Bose had taken a leading part in the research activities of the Institute.

FIRST TRAINING COURSES : JULY 1932

Ad hoc grants were being received from the Government at this time for special enquiries and reports. The first regular grant of Rs. 2,500 per year was sanctioned for three years from July 1931 by the Imperial (now Indian) Council of Agricultural Research. Besides theoretical research on the design of experiments, the programme included giving advice to persons working in government departments and scientific institutions. In the course of dealing with such enquiries, three agricultural officers asked for permission to receive some training in the Statistical Laboratory. With much hesitation we accepted them in July 1932. This is how the training programme started almost exactly thirty years ago. One of our oldest workers, Jitendra Mohan Sen Gupta joined the staff in 1932; and then came

¹ Names with citations are given at the end of the review.

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Raj Chandra Bose in April 1932, Samarendra Nath Roy in July 1933, both of whom are now working in the U.S.A., and K. Raghavan Nair in 1936. The Government of India sanctioned an annual grant of Rs. 5000 from April 1935 for research and advanced studies which made it possible to expand the training programme to some extent.

EXTERNAL EXAMINATIONS IN STATISTICS : 1938

Apart from the individual training mentioned above, the Institute had also taken early action in connexion with the training and examination of technical personnel at various levels. In 1935 the Institute had set up a committee to review the likely future demand for statisticians in India and the need of establishing recognized technical qualifications. On the recommendations of this committee, various examinations were started in 1938 for the award of certificates of proficiency in computation, field survey, machine tabulation, etc., and also for the award of diplomas in statistics practically at the university level. Up to the end of 1961, 11,572 candidates had appeared in these examinations and 3,539 had passed.

FIRST PROFESSIONAL COURSES : 1939

Between July 1932 and July 1939 more than 150 officers from government departments, universities and scientific institutions came to the Institute for individual training and studies. As the demand was increasing steadily it was decided to start in 1939 an organized professional course for one year which was thrown open to persons who had already taken their master's degree.

Another expansion of the training programme took place a little later, on the initiative of the Institute, with the opening of post-graduate classes leading to the M.A., and M.Sc. degrees in statistics in the Calcutta University in 1941. For about five years the entire work of this new department used to be done by the staff members of the Statistical Laboratory and the Indian Statistical Institute; and the university department was located in the rooms occupied by the Institute in the Presidency College in Calcutta. C. R. Rao had joined the one-year training class in the Institute in early 1941, and was also among the first batch of students who joined the post-graduate M.Sc. course in statistics of the Calcutta University in August, 1941.

INTERNATIONAL STATISTICAL EDUCATION CENTRE (ISEC) : AUGUST 1950

In 1950, the Institute again took the initiative in starting, with the support of the UNESCO and the active cooperation of the International Statistical Institute, the International Statistical Education Centre which has been maintained since then with the support of the Government of India mainly for students from the Asian countries. In eleven years since its inception, over 400 students from seventeen countries have attended the courses given in this centre.

In the Institute itself a two-year course was started in 1951, which was restricted to persons who had already taken the master's degree in statistics or in some associated subject. About twenty-five students used to be admitted at that time, and the teaching staff of eighteen were also heavily engaged in both theoretical and applied research. Between 1939 and 1950, about 550 students attended the whole-time professional courses in the Institute.

TECHNICAL TRAINING

The Institute had also started long ago training classes for junior technical personnel (computers, punchers, machine operators, etc.) and has been conducting, for some considerable time, evening courses in statistics at a higher level in Calcutta, Delhi, Bombay and Madras. In addition to the regular whole-time students, the Research and Training School is at present offering twelve part-time, evening, and special training courses to nearly 400 students in different parts of India. Also, good deal of training has always been given, and is still being given, in the form of apprenticeship and short intensive courses in technical subjects outside the Research and Training School, for example, in the National Sample Survey, in Statistical Quality Control, in the Computer Division, etc. Up to 1961, training had been given to over 3500 persons in organized courses and to over 2500 persons in apprenticeship courses. The educational and training responsibilities of the Institute have been thus quite large.

EMPHASIS ON PROJECT WORK

So far I have spoken about the educational activities of the Institute. I should also emphasize that from the very beginning, even in the decade before the formal establishment of the Institute, the Statistical Laboratory was accepting enquiries and projects mostly from government departments and occasionally also from private firms. A big scheme was started in 1937 to develop sampling methods for estimating the outturn of the jute crop in Bengal. This survey was extended very soon to all important crops in the two provinces of (undivided) Bengal and Bihar covering a total area of nearly 150,000 square miles. Various other projects were also being taken up at that time. Some of the most important were in connexion with the control of floods in Bengal, Bihar and Orissa. One report on rainfall and flood had pointed out in 1931 the possibility of building dams in the Orissa river system to hold up water for purposes of flood control and also to use the same water to generate electrical power. This proposal was implemented after a long time in the Hirakud hydro-electric project which came into operation twentyfive years later. There was also a steady expansion of large scale sample surveys. The National Sample Survey was started in 1950 with a programme of collecting information every year on the growth of population, production of food crops, level of living, industrial production, employment and various other socio-economic conditions covering the whole of India. The Institute has been intimately connected with these developments and has continued to do a very large volume of project work on sample surveys on behalf of Government.

INTEGRATION OF RESEARCH, PROJECTS, AND TRAINING

I have been referring to the early history to bring out an important point. Scientific activities in the form of both theoretical and applied research, directed specially to Indian problems, had become well established before the educational programme was started. Also, both theoretical research and applications of statistical methods to special enquiries and projects have always continued to form an important part of the activities of the Institute. The educational and training programme had originally developed, partly as a by-product of research and project work, and partly in order to train technical and professional workers for the Institute's own activities. In fact, a very high proportion of the Institute staff at all levels have always come from among persons who had received their statistical and technical training in the Institute itself. Also, it is worth noting, although the Institute could not award degrees, the students who completed the Institute course

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satisfactorily did not usually find any difficulty in obtaining suitable employment. That is, the training given by the Institute was being generally appreciated on its own merits.

DIFFICULTIES OF INTEGRATED TEACHING IN PROFESSIONAL COURSES

In the professional courses attempts were being made continually to stress on teaching theoretical statistics in close relation to practical applications. Considerable difficulties were, however, being experienced in this connexion. The Institute had deliberately restricted admissions to the professional courses to persons who had already taken their master's degree, usually in mathematics or statistics, from other universities. Although the Institute had maintained a very high standard for admissions, experience showed that many of the students, while possessing skill in dealing with the abstract mathematical portions of statistical theory, had difficulty in using statistical methods in practice. This was mainly due to a lack of sufficient acquaintance with the natural sciences on the part of the post-graduate students who were coming to the Institute.

CONFERMENT OF POWERS TO AWARD DEGREES AND OPENING OF UNDERGRADUATE CLASSES : 1960

It was felt that it might be advisable to admit younger students at an undergraduate level and give them opportunities for acquiring some direct experience of methods of observation, measurement and experimentation in science. From 1953 various suggestions were considered for converting the Institute into some kind of a university, but this did not seem to be entirely suitable for higher education and training in an essentially technological subject like statistics. Finally, the Institute was empowered to give degrees in statistics by a Central Act in 1959; and first admissions at an undergraduate level started in 1960. The award of degrees of Master of Statistics (M. Stat), Ph.D. (in statistics) is starting at this first Convocation in 1962.

NEW TYPE OF TECHNOLOGICAL INSTITUTE

It is worth pointing out that, because of the close integration of research, project work and teaching, the Institute had been obliged from the very beginning to develop educational and training programmes which deviated considerably from accepted models for teaching statistics in universities not only in India but also in the advanced countries of the world. This created great difficulties. For example, in 1945 when the Government of India wanted to develop the Institute as a higher educational institution it was proposed by the Government that the London School of Economics should be accepted as a model and it was seriously suggested that there was scarcely any need for practical classes or of any involvement in project work. Similar difficulties still have to be faced in giving expression to our ideas of a new type of technological institute.

THE DUAL CHARACTER OF STATISTICS

The difficulties which were being experienced in developing an integrated programme of education and training in statistics were due, in a good measure, to the dual character of statistics. It requires stressing that statistics has two aspects, one which is utilitarian or economic and the other which is scientific, mathematical and logical.

The utilitarian or economic phase of statistics had its origin in time immemorial, in the collection of information relating to social and economic conditions of a country to help in making administrative and policy decisions. The English word "statistics" is

connected with statecraft, the business of the State or of Government or Administration. In India and in other countries, during periods of social and economic growth, there has also been a rapid advance of statistics.

The concept of random events came much later, in connexion with games of chance, and the theory of probability was developed at the time of emergence of modern science in the sixteenth and seventeenth centuries.* This had a motivation which was both economic (in estimating the chance of winning a stake or a game) and mathematical or logical.

This dual aspect of statistics led to a dichotomy in teaching and research in statistics, one part being usually associated with economics and the other part with mathematics. This has had some unfortunate consequences. The attempt to teach statistics as a branch of pure mathematics has led to sterile exercises in abstract theorems without any relation to the real world.

STATISTICS AS A NEW TECHNOLOGY

The fact is that statistics is concerned essentially with the world of reality rather than with the world of abstract mathematics. All natural and social sciences (whether pure or applied) are based on observations, measurements, and experimentation where feasible. Also, all such sets of observations, measurements and experimental results are, in principle, a 'sample of the universe' to which they belong. All generalisations based on observations, measurements, and experimentation, that is, all inductive inferences in science must be, in principle, identified with or involve statistical inference. There is also a tendency or at least an attempt to make decisions in technology, engineering, medicine and in every day affairs, more and more, on the basis of an objective appreciation of relevant facts which, again, involve the collection and analysis of data of all kinds. This is the reason why the use of statistical methods is spreading rapidly in all the sciences—both natural and social, in technology, engineering and medicine, in commerce and industry, and in business and administration.

Statistics is thus very much concerned with devising efficient methods of collection of facts, observations and experimental data of all kinds and of extracting the maximum amount of information from such data in a valid manner and at a minimum cost. Logic and mathematics must be used for such purposes as tools and as the language of science, to the fullest possible extent. Modern statistics is thus intimately connected with mathematics, with economics, and with science and technology.

The time has come to recognize statistics as a new and practically universal technology of the present age. In statistics, teaching and research must, therefore, have

*Although games of chance were known and were widely prevalent in ancient times in China, India and other countries, it is important to note that the concept of probability did not arise until the 16th and the 17th centuries, that is, not until the emergence of modern science. This is easy to understand. Before the emergence of the modern scientific view of an objective world of physical reality, all chance events would have to be necessarily ascribed to the whims of gods, demons, or supernatural forces. After the emergence of the scientific view of an objective world of physical reality, it became necessary, both logically and psychologically, for the human mind to accommodate the occurrence of chance events as an integral part of the uniformity of nature. This could be accomplished only on the basis of the theory of probability, or rather, as I should prefer to put it, only through a statistical view of the world. It seems to me, therefore, that the concept of probability or the statistical view of the world did arise at the same time as the emergence of modern science only because it could not possibly have arisen earlier.

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an intimate relation to mathematics, economics, and all the sciences, natural and social. Teaching in statistics must be viewed as something analogous to teaching in engineering or medical sciences. In statistics, teaching, research and applied work must, therefore, be closely integrated.

THE PIONEERING ROLE OF THE INDIAN STATISTICAL INSTITUTE

Ten years ago, on the occasion of the formal opening of the main building of the Institute on 28 December 1951, Sir Ronald Fisher had pointed out the pioneering role of the Institute in this connexion with prophetic vision. I cannot do better than reproduce extracts from his speech on that occasion.

During the twenty years of its existence the Indian Statistical Institute has developed several activities of national, and even to some extent, of international importance. It has in several aspects the character of

- (a) a learned society devoted to the increase of national knowledge in statistical science ;
- (b) a professional organization extending recognition to professional statisticians in various employments ;
- (c) a commercial non-profit distributing corporation capable of carrying out on economic terms projects of fact-finding and analysis for State and Central Governments, and for commercial and industrial organizations ;
- (d) a teaching centre for pure and applied statistics at under-graduate and post-graduate levels ; and
- (e) a publishing house analogous with the university press of many western universities.

It is, I believe, principally of the fourth of these aspects that national planning should take account and make use, for with the great extension, in recent years, both of abstract or mathematical statistics, and of its applications in the economic, administrative and scientific life of modern nations, there has grown up as never before the need of centres for the concurrent study of mathematical statistics, and of its several specific applications. A similar need, which I believe to be rather closely analogous, has been felt in western nations for technological institutes, in which the most advanced methods of applied physics may be studied concurrently with the facilities offered by modern engineering. This dual need has created great institutes, of which many examples might be given, but of which the Massachusetts Institute of Technology is typical, which differ in structure and organization from the traditional University, being particularly charged with the task of bridging the gulf which separates purely academic studies from effective execution and in which consultant work for industry is a duty required of the professors.

The history of the Indian Statistical Institute shows it to have been progressively shaping its organization towards the fulfilment of such a task in relation to the constantly expanding applications of statistical methods. In particular, it has taken the lead in the original development of the techniques of sample surveys, the most potent fact-finding process available to modern administrations, while at the same time it has harboured a series of brilliant mathematicians of world reputation in mathematical statistics. What is most striking is that the mathematical work has been constantly linked with work on the projects, so that practitioners in the applied fields can learn insensibly the uses of mathematical analysis, and the mathematicians can receive the vivifying stimulus of seeing their devices applied in practice. It is the organic unity of theory and practice that has given the Institute its unique status at the present time.

In the course of National Planning such an institution may be either used or wasted. It will be wasted if planning consists of a dull conformity to a blue print of ready-made and foreign conception. It can only be used if planning can

recognize the aptitude of this spontaneous growth as a national resource peculiarly fitted to the current changes of the modern world. Difficulties of organizations may well require its segregation in the future into several economically autonomous, yet closely linked organizations, with different specified tasks. Nevertheless, an organic unity of personnel should be preserved as the only guarantee of harmonious development. In this way it can become a model for similar institutions badly needed by all forward looking communities..

Sir Ronald Fisher's speech, ten years ago, was prophetic not only because it saw what was coming in future but also because it pointed the way to future progress. All the implications have not yet been fully appreciated. He had not only emphasized the importance of the Institute having many facets of activities but had also pointed out the need of future "segregation into several economically autonomous, yet closely linked organizations, with different specified tasks". At the same time, he had stressed the need of preserving an organic unity of personnel as the only guarantee of harmonious development. The logic of events is rapidly moving the Institute in the direction indicated by him.

THE EDUCATIONAL POLICY OF THE INSTITUTE

In the course of its integrated activities and partly as a matter of deliberate policy the Institute has steadily persisted in its efforts to develop a type of statistical education which would best serve the needs of India. The aim is to give the students the opportunity not only to acquire knowledge of statistical theory but also to become proficient in the use of statistical methods in economic planning, science and technology, and in solving practical problems of various kinds.

It is intended to adopt a teaching programme with a very broad base which would include mathematics, which supplies a common language for science, up to a fairly high level; mathematical statistics and application of statistical methods in various fields with actual participation in the collection and processing of statistical data; sample surveys and project work of various kinds; economic planning and the use of statistical methods in social sciences.

It is also intended to give the students adequate opportunities for acquiring experience of making observations, measurements, and experiments in the natural sciences. The Institute has therefore adopted a policy of establishing a number of small research units in different scientific fields. Each such unit should concentrate on intensive research of high quality on carefully selected themes without any idea, however, of developing into big faculties or big centres for undertaking extensive programmes of work which would require a large staff or a large financial outlay. The number of workers in each unit should be fairly small to ensure fruitful team work.

The Institute should have freedom to choose any field of science in which such research units would be established provided research workers of sufficient ability happen to be available. The number of units would be necessarily determined by the limits of availability of financial and other resources. The greatest importance must, therefore, be given to the quality of work with an austere limitation of the volume of work. Also, if the research leaders in any particular unit leave the Institute, there should be no responsibility to continue it. That is, the research units should be organized round research personnel and not on the basis of a selection of subject fields.

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These research units must have close connexions with statistics and will offer facilities, firstly, for the development and application of statistical methods, and secondly, for the training of professional statisticians, in the selected subject fields.

The Institute intends to maintain its policy of highly selective admission and to keep the number of students sufficiently small to give them adequate personal supervision and guidance in their studies. The Institute has deliberately adopted a policy of attracting a small number of candidates of exceptional ability and giving them a comprehensive background of experience of scientific methods to supply a concrete basis for professional training in theoretical and applied statistics. The aim of the Institute would be fulfilled if it succeeds in turning out every year even a small number of graduates of ability with adequate knowledge of the theory and application of statistical methods which now constitute a new and most versatile technology of the modern age.