

## STATISTICS EDUCATION IN INDIA: A REVIEW

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*In the present paper a brief account of Indian Statistical System and contributions of Indians to development of statistics is presented. Statistical education at school and undergraduate levels is discussed in detail. Educational and research activities in statistics at premier institutions and universities are highlighted. In the end some suggestions for future planning at national and international levels in statistics education are made for discussion.*

### INTRODUCTION

The future of statistics needs to be discussed in view of recent development in information technology such as data mining, data communication and information processing networks and requirement of end users. The current statistical methodology based on probabilistic models developed for the analysis of small data sets appears to be inadequate and require some methods to be put forward in the name of data mining for such purposes. In the present talk a brief account of Indian Statistical System and Statistical Education at various levels in India is presented. In the end some suggestions and recommendations for future planning in statistics education are made for open discussion.

### INDIAN STATISTICAL SYSTEM

The Indian statistical system pertains to the collection, compilation and dissemination of data relating to socio-economic, agricultural and industrial statistics in India. Ministry of Agriculture, the Central Statistical Organization (CSO) and the National Sample Survey organization (NSSO) are some of the important agencies at the national level involved in collection, compilation and dissemination of data. The CSO is mainly responsible for coordination of statistical activities as well as evolving and maintaining statistical standards. The NSSO has been a leading sample survey organization since its establishment in 1950 and continues to conduct major multi-subject surveys that provide valuable data required by the policy makers. The NSSO conducts large-scale surveys at the national level and collects and disseminates information on different areas. The NSSO, under the scheme of improvement of crop statistics, also provides technical guidance to the states in respect of the crop estimation surveys and performs sample checks to assess the quality of primary work done by the state agencies in area and crops estimation surveys.

### CONTRIBUTION OF INDIANS TO STATISTICS

There is a long list of well-known Indian statisticians who made outstanding contributions to the development of statistics as a separate subject or discipline: Some of them are mentioned below:

*D Basu:* Bayesian Statistics

*V.S. Huzurbazar :* Bayesian inference properties of the exponential family of distributions and the uniqueness of the likelihood equation.

*D.B. Lahiri:* Lahiri's Method of sample selection with PPS

*P.C. Mahalanobis:* Concept of optimum survey design, Pilot survey,  $D^2$  Interpenetrating network of samples

*C.R. Rao:* Cramer-Rao Lower bound, Rao Blackwell theorem, First and second order efficiency, g-inverse, growth curves, MINUE, Unified theory of linear models.....

*P.R. Masani:* Wiener-Masani theory of Multivariate Stationary Stochastic Processes.

*P.V. Sukhatme:* A pioneer in Agricultural Statistics and sampling through his excursion to the discipline of sociology, nutrition and genetics.

## SCHOOL AND UNDER-GRADUATE STATISTICAL EDUCATION

Realizing the importance of statistics, some elementary topics were introduced at school level in the subject of mathematics. The topics were included at 10+1 and 10+2 levels are: *Definition of statistics, Measures of central tendency, Measure of dispersion, Probability, Correlation and Regression.*

At under graduate level statistics is taught as one paper in B.A. pass and honour courses in mathematics in most of the universities, while some universities have introduced statistics as a separate subject and the contents included in the curriculum are: *Descriptive Statistics, Correlation and Regression, Probability Theory, Random Sampling, Statistical Estimation, Tests of Hypothesis and Analysis of Variance.*

To meet the challenges of teaching statistics to undergraduate students the following suggestions are made for adoption:

- Relevant teaching material be prepared and handed over to the students in the beginning of the course.
- Textbooks may be made available and these should be written keeping in view the objectives of the courses and background of the students.
- The teacher should make efforts to create interest among the students for statistics learning by correlating its teaching with real life problems.
- Teaching should be made experiments oriented and enjoyable illustrating by live examples and using audio- visual aids

## HIGHER EDUCATION AND RESEARCH IN STATISTICS

Statistics is taught in most of the Indian universities at the post-graduate level. Universities in some states offer both UG as well as PG degrees in statistics. ISI Calcutta with its branches in Delhi and Banglore and Indian Agricultural Statistics Institute at New Delhi are engaged in research and teaching both and so is IASRI. In order to impart training at post-graduate level, leading to M.Sc. and Ph.D. degrees, Calcutta University established the departments of statistics in 1943. The several other universities also established separate departments of statistics and started postgraduate program in statistics. The universities which are well known nationally and internationally in statistical education are Calcutta, Delhi, Panjab, Mathurai, Bombay, Madras, Rajsthan, etc.

In addition to these universities Indian Statistical Institute at Calcutta, Delhi and Banglore are imparting statistical education at postgraduate level. These institutions and universities mentioned above deserve the major share of credit for the past and current developments of statistical education in India. There is an International Centre located at Calcutta where eminent statisticians from every corner of the world are invited to deliver seminar and talks. In Indian Statistical Institutes degree courses of statistics are taught to cover a wide range of subjects somewhat analogous to courses in medicine and engineering. Pure mathematics and theory of probability have important place. Statistical theory and different branches of applied statistics and economic planning to suit special needs of India form a large part of the teaching program.

## SUGGESTIONS AND RECOMMENDATIONS

- The time has come to introduce educational programs appropriate for statistics as a fully developed new technology that calls for the utilization of a wide range of scientific knowledge to help in solving scientific or practical problems. As Fisher had pointed out “a profession statistician, as a technologist, must talk the language of both theoretician and practitioner”. The education of a statistician, like that of other technologists, must have a broad base.
- The challenges in statistics education are never trivial, but offer opportunities inherent to the richness of statistics as a discipline and a servant. University structure should tend to encourage competition rather than cooperation among faculties and thus not to reward good service teaching; the juxtaposition of a general decline in quantitative preparation versus increased quantitative needs of business and industry.

- The awareness in the statistical profession and importance of statistics education is the need of the hour. The commitment of teachers to their students and good practice of statistics will lay excellent foundation for the future. However, the challenge to increase awareness and acknowledgement across the country need cooperation with mathematical sciences and other disciplines. The future of statistics needs to be discussed in view of recent development in information technology such as data missing, data communication and information processing networks and requirement of end users.
- The current statistical methodology based on probabilistic models developed for the analysis of small data sets appears to be inadequate and require some methods to be put forward in the name of data mining for such purposes.
- A statistician must have rigorous training on the analysis packages such as SPSS, SAS etc. During the training periods he may be asked to handle practical problems, case studies or small research projects of applied nature. Training should also include the preparation of layout for field experiments and their actual implementation in the field.
- Developments in Statistics are beneficial for both the government departments and private industry. Therefore, research scholars and faculty from the universities and research institutions involved in statistical research must be provided with fellowship and research grants from government departments and private industries to the tune of advanced countries.

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