

# STATISTICS IN ACTION: A COLLABORATION OF STATISTICIANS AND RESEARCHERS

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## ABSTRACT

*It has been often experienced that the researchers (or even research guides), who are very confident about the logics and choices in research methodology, get somewhat shaky when it comes to applying statistics to their own (or their students') researches. In order to provide a common platform for the statisticians and researchers a four-day long International workshop was conceptualized. It was aimed at giving scope for their possible discussions and collaborations in order to handle a research problem in a more intellectual and logical manner. The workshop was designed in such a manner that the participants got enough scope in collaboration with each other. In fact they were put in pairs / groups even before the actual workshop commenced. The feedback gathered was analysed both quantitatively as well as qualitatively. There was some enlightenment through this experience. The efforts to demystify statistics are required at various levels and on various fronts. Such continued efforts will make the researches more worthy of usage.*

**Key words:** research competency, statistical tools, workshop

## Paper

## I. INTRODUCTION

The concept of learning throughout life emerges as one of the keys to the twenty-first century. It goes beyond the traditional distinction between initial and continuing education. It meets the challenges posed by a rapidly changing world. In view of this Delor (1996) has put greater emphasis on four pillars through the mile-stone document "Learning: The Treasure within": learning to know, learning to do, learning to live together, and learning to be. Out of these 'learning to do' is more closely linked to the competency development. It cannot have the simple meaning it had when it was a matter of preparing someone for a clearly defined practical task in order to contribute to the manufacture of something. It also underlines a shift from skill to competence.

Research in higher education in any field is an attempt to create new knowledge. A research involves many complex and abstract processes like conceptualization, theorization, creation, argumentation, analysis, interpretation, critical reflection to name a few (Dharankar, 2014). Unless one has competencies needed to do justice to these abstract processes, the research cannot reach to the quality level that it is expected to. Data analysis is an important set of competencies for a researcher. One is expected to

- Utilize appropriate data analysis techniques consistent with the purpose and design of a study.
- Interpret, analyse and synthesize the findings in light of the existing literature and theoretical framework, and identify relevance for practice and future research.



It has been often experienced that the researchers (or even research guides), who are very confident about the logics and choices in research methodology, get somewhat shaky when it comes to applying statistics to their own (or their students') researches. If one looks at this scenario from the statisticians' point of view, the statisticians need to get the real life data to work with rather than just the theoretical or hypothetical data.

## **II. AN INITIATIVE TO BRING RESEARCHES AND STATISTICIANS TOGETHER**

In order to provide a common platform for the statisticians and researchers a workshop was conceptualized. It was aimed at giving scope for their possible discussions and collaborations in order to handle a research problem in a more intellectual and logical manner. A four-day long International Workshop was organized for the purpose. This initiative was taken by the International Statistical Institute's (ISI) Outreach Committee for South Asia with the academic partnership of Yashwantrao Chavan Maharashtra Open University, Nashik and B. Y. K. College of Commerce, Nashik with the support of World Bank Trust Fund for Statistical Capacity Building.

The workshop was targeted towards the scholars of the following types:

- Statisticians interested in applications
- Biologists or Social Scientists active in research in which use of statistical tools is vital.
- Aspiring applied statisticians, research students and post-graduate students

The capacity of the workshop was limited to 50 as close one-to-one work and discussion was expected. A few seats were reserved for Nationals of Bangladesh, Bhutan, Nepal, Pakistan, and Sri Lanka. Some preference was also given to government officials.

## **III. CONTENT AND MODALITY OF THE WORKSHOP**

The workshop was organized in such a manner to maximize the scope for discussions and collaborations between the researchers and statisticians. Hence the workshop was not limited to the four days of the event, but the time slots before and after the workshop were also utilised. The activities during each time slot are discussed below:

- Pre-workshop activities: There were mainly two activities organized during this phase:
  - Project competitions among undergraduate and postgraduate students, teachers' forum on problems in statistics education
  - The participants, especially the researchers, were asked to apply with the evidence of project work. They were asked to provide the details about their subject of interest, experience in application of statistics. So reference was given for those researchers, who had already gathered data and who were seeking advice or assistance for statistical analysis. These kinds of participants were asked to share their research in short and were also asked to mention about the specific questions they had in mind regarding statistical analysis. In whichever cases it was possible, they were put in contact with each other even prior to the event so they can start having dialogue and can work towards solution.



• Main Workshop of Four days: The sessions designed for the workshop were of variety of types. The work done during pre-workshop phase was utilized for optimum benefit. The main features of the workshop program were:

- Lectures on case studies by senior applied statisticians – since they had worked in a variety of area and disciplines, it provided a wide arena of applications.
  - Joint presentations by the researchers and the statisticians – These were emerged from the dialogue between the two during pre-workshop phase. Many of them had not yet reached solutions, but they were in the process. One such presentation also demonstrated the kind of dialogue (= actual questions – answers between the researcher and the statistician) they were having. This gave clarity on the kind of questions both of them have while beginning to work with each other. This also threw light on the kind of preparation researcher needs to have prior to getting into a research.
  - Presentations of research problems and data (being) gathered – A few presentations were of this kind and there were deliberations on the appropriate statistical analysis they could use.
  - Laboratory sessions on illustrative computations – This gave hands on practice.
  - Panel discussion so an international collaborations across disciplines, leading to recommendations to the ISI for activities to promote use of statistics in various walks of life.
  - The most interesting part of the workshop was the researchers and the statisticians were sitting together during and even beyond the official working hours of the workshop.
- Post-workshop activities: Some pairs of researcher-statistician continued working in collaboration even beyond the workshop.

**IV. GEOGRAPHICAL SPREAD OF PARTICIPATION**

The participants were from some Asian countries like Sri Lanka, Bangladesh and a major portion from India. Within India the participants represented Gujarat, MP and Maharashtra. There were total 49 participants spreaded across wide spectrum of disciplines like the life survival disciplines like life sciences to luxury areas like cosmetics. Almost half the participants were from statistics.

There were total 41 cases presented / discussed during this workshop. Table 1 gives the day-wise spread of these presentations.

**Table 1**  
**Total Papers Presented**

<b>Day</b>	<b>Number of Presentations</b>
1	12
2	09
3	12
4	08
<b>Total</b>	<b>41</b>

As the participants were from a variety of disciplines the cases of researches were from a variety of areas. Table 2 gives details of these areas.

**Table 2**

**Spread of Disciplines and Areas discussed during the Technical Sessions**

Sr No	Discipline	Areas	Number of Sessions/ Presentations / Discussions
1	Health Sciences	Govt. Health Services, Drug discovery, Anemia, Survival Analysis, Efficacy of Ayurveda, Antibiotics, Malaria and Mosquito, alternative medicine	9
2	Agricultural Sciences	Agricultural extension, Animal abundance, Forestry, Microbiology, Marine pollution , Bee Keeping industry, Plant growth	8
3	Social Sciences	Measuring Poverty, Astrology, Gender bias, arts, Psychiatry, Radio audience survey	6
4	Education	Communication Research and related issues, IQ, Olympiad, Special Education, Techno-andragogy	5
5	Biological Sciences	Bioassay, toxicology, theory of evolution	4
6	Statistics (as discipline)	ANOVA, Mixture Binomial Model, Innovations in statistics teaching	3
7	Commerce	Microfinance, Business analytics	2
8	Engineering and Design	Automobile Engineering, Carpet design	2
9	Sports	Cricket	1
10	Luxuries of life	Cosmetic trials	1
		Total	41

Thus one can note that the disciplines ranged from live-survival to luxuries of life. The research cases of the health sciences dominated the most as the numbers depict.

**V. INSTRUMENTS FOR DATA COLLECTION**

In order to take a judgment on to what extent this innovative workshop was useful and whether the participants want to voice any suggestions, feedback was gathered from them. Two instruments were used for gathering feedback from the participants.

5.1 Session feedback: This was used for each session. A day-wise sheet was designed and developed. It was a likert-type rating scale with five options - Excellent, Very Good, Satisfactory, Needs Improvement and Poor having the ratings of 5, 4, 3, 2 and 1 respectively. The aspects to be rated were – Presentation Rating, Content Rating, and Overall Rating Beyond this quantitative rating the respondents were also expected to give qualitative comments to the presenters – both positive as well as in the form of suggestions for improvement.

5.2 Overall feedback: This was used at the end of the event. It was also a likert-type rating scale with five options - Excellent, Very Good, Satisfactory, Needs Improvement and Poor having the ratings of 5, 4, 3, 2 and 1 respectively. The aspects to be rated were – Venue, Administrative Support, Lodging Arrangement, Food, Hospitality, Transportation, Delegate Pack / Material Given, Time Management, Duration of Total Program, Interaction offered with Resource Persons, Benefits Derived. Beyond this quantitative rating the respondents were also expected to give qualitative comments to the organisers – both positive as well as in the form of suggestions for improvement. There was also a question related to their plan to build / use the tips / learning that one has picked from the event.

## VI. DATA ANALYSIS

The data gathered through the feedback sheets was of both the types – quantitative as well as qualitative. Hence there are two part of this analysis accordingly.

### 6.1 Quantitative Analysis

The rating scale part of the feedback sheets were used for this analysis. Since there were two types of feedback sheets used capturing the participants' say, this section is further divided into two parts – feedback on the technical sessions and the feedback on the overall event.

#### 6.1.1 Quantitative feedback on the technical sessions

The ratings given by the participants were converted into percentages for the purpose of tabulations and analysis. Though they were instructed to choose the rating as a whole number ranging from 1 to 5, they gave the ratings in fractions. The highest rating was of 98.06 % while the lowest was 65.41 %. Table 3 gives the frequencies on the various aspects of the feedback as well as for the total rating scale.

**Table 3**  
**Aspect-wise Frequencies of the Participants**

<b>Percentage Rating</b>	<b>Presentation</b>	<b>Content</b>	<b>Overall Rating</b>	<b>Total Score</b>
61 - 65	0	1	0	0
66 - 70	3	6	5	5
71 - 75	5	9	10	9
76 - 80	13	7	7	9
81 - 85	4	7	5	4
86 - 90	9	5	7	7
91 - 95	1	5	6	6
96 - 100	5	0	0	0
<b>Total</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>

This data base has been used to get a visual picture of the feedback. Figure 1 shows the quantitative feedback on technical sessions in graphical form.



Figure 1: Graphical Representation of the Summary of Quantitative Feedback to Technical Sessions

Observation: The graphical representation clearly shows that it is a bimodal distribution for the aspects of ‘presentation’ as well as for ‘overall rating’ and so also for ‘total score’.

Interpretation: One major implication of a bimodal data set is that it can reveal to us that there are two different types of individuals represented in a data set. In this case, it may be interpreted that one group is over-prepared, while another group is under-prepared for making the workshop experience gainful for self.

#### 6.1.2 Quantitative feedback on overall event

The quantitative feedback given by the participants on the overall event organization has been tabulated in table 4.

Table 4  
Rating of the Overall Event

Sr No	Aspect of Feedback	Rating
1	Venue	97.80
2	Lodging Arrangement	94.40
3	Food, Hospitality	94.40
4	Administrative Support	92.80
5	Time Management	90.20
6	Delegate Pack / Material Given	90.00

7	Interaction offered with resource persons	88.20
8	Benefits derived	87.20
9	Duration of Total Program	85.20
10	Transportation	84.40
	<b>Overall</b>	<b>90.46</b>

The facilities like venue, Lodging Arrangement, Food, Hospitality have been rated highest amongst all. The explanations of the little low rating on the aspects like Interaction offered with resource persons, Benefits derived, Duration of Total Program, and Transportation can be sought from the qualitative analysis that follows further.

## 6.2 Qualitative Analysis of the Feedback

The data for qualitative analysis was available from both the feedback sheets. The total qualitative data has been categorized under various headings - positive feedback, learning about statistics, intend to build / use the following tips / learning that are picked from the event, lacunas, and suggestions received for the future events related to statistical analysis. The details under each are given ahead. The aspects such as positive feedback, learning about statistics, intend to build / use the tips / learning that are picked from the event give the qualitative explanations about the high ratings for the technical sessions and overall event. The aspects such as lacunas, and suggestions received for the future events related to statistical analysis give the qualitative explanations about the low ratings for the technical sessions and overall event.

### 6.2.1 Positive Feedback

The reactions of the participants are quite motivating.

- I loved to listen to sessions, excellent presentation, enjoyed thoroughly. It was like sitting in class and lot more! Enriched and touched all the points, very communicative and interactive.
- Good presentations, content was good and incorporated all topics, interesting
- The structures of the tables included in the presentations were self-explanatory.
- One of enriching event I have ever attended. This event taught me how statistical consultant deals with the various questions they faced. Also how collaboration with researchers and statisticians are important to draw the meaningful results.
- Also made excellent friends with whom I propose to work in collaboration in future. Main advantage was the contacts that I made during this meeting.
- Because of multidisciplinary participants, we had golden opportunity to listen & to share their problems in research area. There was diversity in the research topics across disciplines. We got an opportunity to look into various social problems for application and use of statistics. Got to know how statistics is in action in various fields and fell in love with the procedures of statistics & I plan to learn more. Came to know about applications of statistics in different area and problems, people finding in their research.



- Time was optimally used. It gave more scope for informal discussion and interactions with experts. There was ongoing liaison between users & applied statisticians.
- Very good interactions reflect on success of workshop.
- Excellence - in conception, design & implementation of event

### **6.2.2 Learning about Statistics**

The exact content-wise gain by the participants is evident from their responses.

- Statistics in more useful when number of variables are more.
- It is advisable to involve and consult statistician right from the design stage of study.
- Underlined the relationship between
  - What was 'felt', 'sensed' during data collection and statistical analysis
  - Data of "process" and that of "product"
- I learned to use step-wise correlation to analyse the data.
- Getting basic knowledge about statistics & methodology is essential for every researcher.
- I learnt a lot about Nitti- gritty of the statistics. It gave better insight of statistical applications.
- Statistics:
  - As a young statistics practitioner, I learnt a lot on how statistical methods should be applied to real world problems.
  - We knew the problems in books, but since real data was available it was helpful in gaining insight
  - Learnt a great deal about using statistical techniques to take the research further and make claims.
  - Learning about Research methodology
    - Learn deeper about analyzing survey questionnaires
    - Research methods are closely linked with both logic and statistics.
    - Design of experiments & alternatives.

### **6.2.3 Intend to build / use the tips / learning that are picked from the event**

Though this was an initiative, it was certainly NOT expected to be an end. This section throws light on how they had further decided to build on this new enlightenment.

- To analyse the data, which is having small sample size, with appropriate method of statistical analysis
- Shall involve myself in areas involving statistical analysis.
- Explore various areas and read more about areas, where statistics can be applied
- While teaching statistics for undergraduate students, I will inform students about various applications of stat in various fields & research areas where statistician can help in decision making & statistic can help in checking excellence of any procedure, efficacy of new instrument in educational field which in very relevant to society.
- Involvement of statistician from conception of the project.
- Learn statistics techniques, which are useful for data analysis.
- Paying detailed attention to designing from analysis point of view





- I will try to extend learned things from this workshop to my job profile. I will contribute more meaningful in my work.

#### **6.2.4 Lacunas**

These were the areas that could be worked on further when similar event is organized.

- ‘Different variables & samples can improve the work, logic of statistics’ – This concept was not understood
- Some raw data should have been shown.
- Some clarity of topic for layman was needed
- Small font size used in some presentations
- A deeper look of ‘what is expected by the statistician during discussion’ was expected.
- Theme-wise sessions would have been more helpful than a random sequencing of papers.

#### **6.2.5 Suggestions received for the Future Events related to Statistical Analysis**

These are the areas which the organizers need to keep in mind for immediate and far future.

- Follow up activities of this Workshop
  - Online forum to shoot queries, group formation with an identical problem, association needs to be formed
  - conference/ workshop to access the success of partnerships forged may be organized. This can be a city-level event.
- Content of Future Workshops
  - Workshops could be planned to train and to specialize a person for a particular tests, technology and analytical tools etc.
  - Users should be trained for how to enter, to code the collected data that can be used for properly for data analysis.
  - Basics of statistics and especially about various types of tests should be covered.
- Detailing of the Future Workshops
  - More and frequent such workshops may be organized by categorizing the audience, by clubbing a few disciplines. E g, biomedical / agricultural sciences, engineering / technological sciences. These could be of smaller duration, focused interactive group sessions with research groups in specific field. E g, Medical, Engineering, agriculture, etc.
  - Some sub-groups (say biology, ecology, economics, etc for example) may be formed. Each group should be advised / taught by a good statistician to help the stat- user to get through their problems.
  - More time may be given to the researcher and statistician to discuss about their joint work.
- Undergraduate students participation (especially statistics) can be targeted so that they get real life data experiences.
- In future, I kindly request the organizers to promote this type of event in a more efficient way.



## **VII. CONCLUSION**

Statistics is something that brings little worries for the researchers (with a few exceptions). Hence the efforts to demystify statistics are required at various levels and on various fronts. Such continued efforts will certainly make the researches more worthy of usage. The efforts on the part of researchers, guides, statisticians, associations are needed.

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