An Experiment in Motivational Techniques to Supplement Formal Education of Statistics at the Higher Secondary/Intermediate Level

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1. Preliminary remarks

The prevalent system of primary, secondary, and undergraduate education in Pakistan is such that, by and large, it promotes a "mechanical" style of teaching on the part of the teachers and passive acceptance of information on the part of the students. It is of the utmost importance to promote in the students the spirit of enquiry, and to change their approach toward learning from that of passivity to that of creativity. In view of the above, a series of experiments has been initiated by the Department of Statistics at Kinnaird College for Women, Lahore, in order to supplement classroom lectures with projects that aim at promoting in the students intellectual curiosity and enabling them to associate theoretical concepts with real-world problems.

This paper presents some of the salient features of that particular experiment which involved students of the FA2 (Intermediate Arts Second Year) Statistics class at Kinnaird College during the academic year 1988-89. The experiment seems to have been successful, and it appears that if such an exercise is made an integral part of the teaching of statistics at the higher secondary/intermediate level, it may prove to be an effective means not only of consolidating in the students' minds some of the basic concepts of statistics, but also of promoting in the students self-confidence, self-expression, and the capability for teamwork.

2. The experiment

2.1 *Introduction*

The idea of the experiment was conceived by the author some time in the summer of 1988. In Pakistan, by and large, statistics is offered as an elective subject only at the FA/FSc and higher levels. Most of the FA2 Statistics students are less than 17 years old, and have been studying statistics as a separate subject for only one year. Consequently, it was felt that the projects undertaken by these students should be fairly small-scale - they should not require too much time for their completion. It was felt that the experiment would serve its purpose even if the projects achieved nothing more than enabling the students to realise the association between theoretical concepts and real-life phenomena. Not much attention would need to be paid to proper sampling procedures at this stage, and it would be sufficient to obtain data from "convenience" samples - quantitative and qualitative measurements that are most easily available.

The idea of the experiment was presented to the Statistics Faculty and the students of the FA2 Statistics class in early October 1988. It was proposed that a number of projects involving the collection and analysis of real-life data be undertaken by students under the supervision of their teachers, and that the results obtained from the projects be utilised to hold in the college hall a *Statistical Exhibition* - a poster display consisting of attractive diagrams/graphs pertaining to the results obtained. Along with the above, a Cuttings Composition was agreed upon, the cuttings received being utilised to enhance the appeal of the poster exhibition.

The entire exercise took about four months and culminated in a colourful and attractive exhibition at Kinnaird College for Women on February 26, 1989.

2.2 *The projects*

It was decided that, by and large, data be collected on various aspects of life at Kinnaird College, and the following three categories of projects were defined.

A. *"Static" Projects* - those in which data would be collected at Kinnaird College on *some particular days* and, as such, would throw light on the state of affairs at the college on *those particular days only*. The following five projects were agreed upon:

(i) Condition of Bulbs and Fans in Classrooms
(ii) Condition of Academic Buildings' Toilets and Hostels' Toilets
(iii) Books Issued at the College Library
(iv) Consumption of Tea and Cold Drinks at the Canteen
(v) Litter in the College Grounds

B. *"Dynamic" Projects* - those in which data would be collected not on any one particular day but *over a number of days*. The following five projects were agreed upon:

(i) Hymn Sung at Morning Assembly at Kinnaird College
(ii) Books Issued at the College Library (over a number of days)
(iii) Attendance at Morning Roll-Call at the College
(iv) Hostel Life at Kinnaird College:
  (a) Lunch in the College Mess (Menu and Attendance)
  (b) Visitors Received by Resident Students
(v) Newspapers' Headlines (This was the *only* project that did not pertain to life at Kinnaird College.)

C. *"Expostfacto" Projects* - those in which data would be collected from Kinnaird College about something that had *already* occurred. The following two topics were decided:

(i) Statistics Students' Class Attendance as Compared with their Attendance at Monthly Tests
(ii) Statistics Students' Marks in the Theory Examination as Compared with their Marks in the Practical Examination

Some of the salient features of the methodology that was adopted regarding the organisation of the students in order to collect and analyse data for the various projects are as follows:

(i) Students were involved in the projects on a *voluntary basis*, and the 43 students who showed interest were formally registered.
(ii) It was decided that each project be undertaken by a *committee* of students under the supervision of one of the teachers, and the various project committees were formed in such a way that each student was given the responsibility of working on exactly *two* projects - no less and no more.
(iii) Each project committee was advised to elect from among the committee members its *leader*, and the larger committees elected their *deputy leaders* as well.
(iv) The leaders and deputy leaders of the various committees were advised that they held a position of responsibility, and that they would be required to act as *coordinators* between the supervisors (the teachers in charge) and the committee members. They were required to properly distribute the work among the committee members, and to ensure that deadlines for the completion of various tasks were met.
(v) Students were informed that the supervisors would meet the committee members primarily in the *short breaks* following each set of three consecutive teaching periods of 45 minutes each. During these breaks, the supervisors would guide the committee members regarding data collection, data analysis, and diagrammatic/graphic presentation of results; the committee members would be expected to carry out the work according to the guidelines in their free time.

2.3 *Preparation of posters*

Once the results of the analysis of the various data sets were available, the next step was the preparation of posters for the Statistical Exhibition. Some of the rules that

were laid down in this regard are:

(i) Each project committee was directed to prepare between three and five posters - no less and no more - containing diagrams/graphs depicting the results of that particular project.

(ii) In order to give proper recognition to all the committee members, each committee was directed to prepare a poster containing:
   (a) the name of the committee leader;
   (b) the name of the deputy leader (in the case of larger committees);
   (c) the names of all the other committee members in *alphabetical order*; and
   (d) the name of the supervisor (the teacher in charge).

2.4 *Cuttings Competition*

In addition to the supervised projects as described above, a cuttings competition was launched which was open to *all* the statistics students at Kinnaird College. The competition consisted of the following two categories:

A. *Cuttings containing "compiled statistics"* - cuttings from newspapers, journals, and magazines of news items or articles that contained various types of compiled statistics (such as statistics of the Seoul Olympics (1988), statistics of the general elections in Pakistan (November 1988), etc.).

B. *Cuttings containing "probability statements"* - cuttings of news items or articles that contained statements involving the concept of probability (such as "It is very unlikely that ...", "Chances are that ...", etc.).

It was announced that for each of the above categories, the student submitting *the largest number of cuttings* would be awarded the first prize.

Having ascertained the prize-winners of the two categories (after the deadline for the submission of cuttings), cuttings were sorted according to contents, and posters were prepared by pasting selected cuttings on chart paper. These posters were to be included in the forthcoming Statistical Exhibition.

2.5 *The Exhibition*

The entire morning of Sunday, February 26, 1989 was devoted to the Statistical Exhibition at Kinnaird College for Women, Lahore. Some of the salient features of the exhibition are given below.

(i) *The Poster Display:* All in all, about 75 posters had been prepared for the exhibition, and the same were displayed in the college hall. The students who had worked on the various projects stood next to the posters and explained the various diagrams, graphs, and cuttings to the audience as they walked around the hall. A spirit of enthusiasm and teamwork prevailed among the FA2 Statistics students throughout the day.

(ii) *The Verbal Presentation:* The highlight of the day was the Verbal Presentation - an hour-long programme in the exhibition hall in which, among other things, students addressed the audience and presented brief descriptions of the various projects that they had worked on. The staff member in overall charge of the exhibition (i.e. the author) acted as compere/moderator for the programme during which a few minutes were devoted to a question-answer session in which the audience was invited to put forth any questions that they had in their minds. The programme acquired a festive mood when prizes were awarded to the winners of the Cuttings Competition.

(iii) *The response of the audience:* In order to be able to obtain the candid views of the audience regarding the merits and demerits of the exhibition, the audience was invited to write their comments in notebooks that had been placed in the exhibition hall for this purpose. We were happy to receive comments from a fairly large proportion of the audience who included, among others (a) the staff and students of Kinnaird College, (b) parents, sisters, etc. of the students who had worked for the exhibition, and (c) teachers and students of statistics from various colleges in Lahore. The comments received from the visitors showed that the exhibition, which was probably the very first of its kind in Lahore, stimulated quite a lot of interest and was well-received and appreciated.

3. Discussion

3.1 *Advantages of such an exercise*

In my opinion, an exercise of the type described above is beneficial for the students in a number of ways, some of which are as described below.

Firstly, such an exercise assists in changing the students' approach toward learning from that of passivity to that which promotes *the spirit of enquiry*. Projects which require the students to begin from scratch, to derive something meaningful out of a mass of real-life data, and to arrive at an overall conclusion, present a *challenge*; such an exercise assists in enhancing the students' *power of decision-making* which is, indeed, one of the basic purposes of education.

Secondly, collection and analysis of real-life data enables the students to realise the association between theoretical concepts and real-life phenomena. Statistical analysis of real-life data is, indeed, an effective way of clarifying and consolidating in the students' minds some of the basic concepts of statistics which are probably not much more than *abstract* ideas when taught in the classroom.

Thirdly, a Statistical Exhibition of the type described above promotes in the students, on the one hand, *creativity* and *self-expression*, and on the other, *self-esteem* and *self-confidence*. Freedom to prepare colourful posters depicting statistical results promotes creativity and innovation, and brings out the artist in a student; an opportunity to speak over the microphone assists in overcoming the fear of addressing an audience and promotes self-expression. Successful accomplishment of the tasks of poster preparation and public speaking endows the student with a sense of achievement and, as such, enhances self-esteem and self-confidence.

Fourthly, the opportunity to work in groups under the supervision of teachers enhances in the students qualities of character such as discipline, responsibility, tolerance, cooperation, and courtesy - in short, the capability for *teamwork*.

In addition, there are special advantages of analysing data that has been picked up from *within* the college. Not only does such an approach facilitate greatly the task of data collection, but it also helps in increasing *the level of awareness* among the faculty as well as the student community regarding various aspects of college life. The results obtained can be used as a *guideline* for improving the conditions of the college in accordance with the needs of the college community.

3.2 *The importance of fair play*

The importance of fair play cannot be over-emphasised, and it must remain an important concern for the faculty in charge of an exercise that involves a number of students. Impartiality on the part of the teachers ensures contentment on the part of the students, and promotes smooth progress of work without fear of resentment or bitterness.

Favouritism *must not* be exercised when distributing the work among the students, and efforts should be made to give *all* those students who express the desire to do so, an opportunity to undertake a particular task - whether it be data analysis, preparation of posters, or verbal description of projects over the microphone. Wherever it becomes necessary to impose a limitation on the number of students to be assigned a particular task, students should be selected, wherever possible, not by personal judgement, but by the use of *random numbers*. The lottery method is, indeed, one of the easiest ways of assuring the students that the teachers are unbiased and impartial, and bears fruit in the form of goodwill and comradeship that prevails among the staff and students throughout the period of the exercise.

3.3 *Compulsory participation versus "the volunteer approach"*

There are two ways of incorporating projects of the type described above in the educational scheme of statistics at the higher secondary/intermediate level. One is to include it in the prescribed curricula of statistics and to reserve *marks* for them, the other being to adopt "the volunteer approach" - to invite students to undertake such an exercise on a purely voluntary basis.

The disadvantage of the first method is that the fear of losing marks *overshadows* the sense of discovery and excitement, thus making the exercise an obligation for the students rather than a pleasurable experience. The volunteer approach, on the other hand, attracts mainly those students who are *genuinely* interested in such work and, as such, a high level of motivation and enthusiasm is obtained in the very beginning. The promise of an exhibition/programme at the end of all the hard work gives the students something to look forward to, and keeps the interest alive throughout the exercise. The desire for *recognition and appreciation* is deep-rooted in man, and the promise of applause by an audience is an incentive that exploits this fundamental human trait in a positive and constructive way.

The knowledge that the higher the quality of the final presentation, the more appreciation it will bring, motivates the students to strive hard, and the absence of

psychological deterrents, such as the fear of losing marks, makes the exercise an experience in *fun* and *fulfilment*. The exercise may turn out to be an experience pleasant memories of which are cherished by students years after its completion.

The only major disadvantage of the volunteer approach is that it fails to motivate *all* the students in a class to undertake such an exercise and hence to gain an insight into the practical application of the subject. What is preferable: compulsory participation or a high level of motivation? This is, indeed, one of the issues that need to be resolved. In my opinion, the advantages of the volunteer approach *outweigh* its disadvantages.

3.4 *Incentive for teachers to undertake such an exercise*

Evidently, an exercise of the type described above demands considerable time and effort over and above what is required for classroom teaching and other routine duties. It must be borne in mind, however, that it bears fruit for the teachers in that it makes their work *more interesting and enjoyable*. It is indeed an *effective* way of breaking the monotony of teaching the same syllabus year after year as well as of checking assignments and marking papers. The opportunity to plan an exercise on one's own provides a sense of freedom and creativity; the prospect of holding an exhibition or a programme provides something to look forward to during the exercise, and well-deserved appreciation at the time of the exhibition/programme brings gratification and fulfilment.

Collaboration between colleagues on an exercise of this type provides an opportunity to work in concordance with each other, and to benefit from each other's knowledge and experience. Mutual respect and cooperation exerts a positive influence on the students, and promotes smooth progress of work.

Close contact between the teacher and the students promotes better understanding and greater trust in each other. A stronger relationship between the teacher and the students promotes not only a more congenial atmosphere in the classroom, but also a higher level of communication during lectures. Last, but not least, a sound and healthy relationship between the teacher and the students possesses the capacity to transcend the "here" and "now", and may prove to be a source of mutual enrichment in years to come.

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