Statistical Project Competition for Secondary School Students - A Hong Kong Experience

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1. Background

The teaching of statistics in the secondary schools of Hong Kong dates back to the late sixties when statistics was first included in the secondary school mathematics curriculum. Since then, statistics has formed only a small portion of the mathematics syllabus and one regarded by many teachers and students as relatively unimportant. In an appraisal of statistics teaching in Hong Kong secondary schools, Cheung, Lam, Siu and Wong (1986) reported the following weaknesses in the local statistics education:

(i) The subject matter is not relevant to students.
(ii) The subject matter is not taught in a lively manner.
(iii) There is a wrong emphasis on techniques rather than concepts.
(iv) The non-mathematical aspect of the subject is ignored.

Among the recommendations for overcoming these weaknesses, one suggestion was to encourage students to participate more in statistical projects. The educational value of projects is well recognised by statistics teachers; see, for example, Dolan (1979), Schoeman and Steyn (1979). However, in a survey of Hong Kong secondary school statistics teachers conducted in 1986, it was found, disappointingly, that 77.4% had never given any statistical project to students.

To remedy this unsatisfactory situation, the Hong Kong Statistical Society launched Hong Kong's first Statistical Project Competition for Secondary School Students in the fall of 1986. Since then the competition has been repeated annually and the fourth competition was concluded on April 29, 1990. The first competition was targetted at students in Form 3-Form 5 (aged 14-16) only. From the second competition

on, all students from Form 3-Form 7 (aged 14-18) were included. Those in Forms 3, 4 and 5 competed in the Junior Section, and those in Forms 6 and 7 competed in the Senior Section.

2. Aims and format of the competition

The competition was organised with the aims of encouraging students to understand the community in a scientific manner through the use of statistical methods and information, promoting students' interest in statistical methods, and providing an opportunity for students to apply their statistical knowledge to real situations.

In the competition, students are requested to submit a project in the form of a report either in English or Chinese. The topic of study should be on some aspect of Hong Kong society like the Hong Kong economy, population, education, housing, industry, and so on. Topics should not be too broad, so that in-depth studies can be made. Specifically, students are asked to identify a theme of study, to select data set(s) relevant to the study, to present, analyse and interpret the data obtained, and to prepare a report.

In the third step above, students are asked to present the relevant data, using summary statistics or graphical techniques where appropriate, and to analyse the data to dig out the facts and information behind the figures. Discussions and arguments should be based mainly on the data presented.

The students are informed of the following criteria for adjudication:

(i) relevance of data presented to the theme of study;
(ii) proper presentation of data;
(iii) proper analysis and interpretation of data;
(iv) full exploitation of data;
(v) appropriate and correct use of statistical methods;
(vi) accuracy in handling data;
(vii) sound and logical arguments;
(viii) proper use of graphs and tables to illustrate findings;
(ix) fluency, clarity, conciseness and orderliness in reporting.
(x) The report should be neat and tidy. Special credit will be given to ingenuity shown in the project.

In the first three competitions, students were not allowed to use their own data, which had to come from Government publications. There are arguments for and against this particular regulation. Among its advantages are that it saves students time in collecting their own data. As examination pressure is high in Hong Kong, teachers may not like their students spending too much time collecting data. Also, if students were in the streets collecting data, their safety may be a concern to parents, teachers, and school principals. Also, data are more reliable if they come from Government sources, and it is easier to check the sources and verify whether they are quoted correctly. Finally, there is educational value for the students in knowing what kind of Government statistics are available for the understanding of Hong Kong society.

Among the disadvantages are that students will not have the first-hand experience of collecting data themselves. Experiences like interviewing a classmate or a household may be beneficial to the growing up of a student. When students collect their own data, they have to do the compilation as well. Statistics from Government publications are already compiled and are too ready-to-use. Finally, the possible topics are too restricted. Students cannot study their more immediate surroundings like their classmates, their schoolmates, their local communities, etc.

In the last competition, the restriction of using only data from Government publications was lifted for the Senior Section. In a number of projects in this section, students did go ahead with their own data collection and reaction from students was quite favourable. Several participating teams referred to their experience in collecting data as "beneficial" and "unforgettable".

The format of the latest competition differed from the previous three in another aspect. Teams in both sections were shortlisted for an interview. In the interview, students were asked to present verbally their work in the project, and answer questions raised by the adjudicators. In the previous competitions, adjudicators did not know how much of the students' ideas and work came from books or from their teachers. With an interview, adjudicators can tell how much effort the students have put in and how much they really understand the material.

From the second competition onward, a briefing session was held for all potential participants. In the briefing session, rules and regulations about the competition were explained, previous entries in the competition were exhibited, and questions from students and teachers were entertained. A short lecture on mistakes commonly found in statistical projects was given. This session should raise the standard of students' entries to the competition by forestalling some common mistakes.

3. Participants of the competition

Students can join the competition as individuals or as a team consisting of up to four members. In the most recent round, there was no restriction on the team size for the Senior Section. However, very few teams consisted of a single member or more than four members. Most teams consisted of three to four members. Table 1 summarises the numbers of participating teams in both sections in the past four years.

TABLE 1
Number of participating teams by section, 1986/87-1989/90

	1986/87	1987/88	1988/89	1989/90
Junior Section	40	42	50	62
Senior Section	---	24	32	29
Total	40	66	82	91

There are over 400 schools in Hong Kong. Less than 10% of the schools participated in the competition each year. Such response is not totally satisfactory. But taking into consideration that Hong Kong schools are very examination conscious and that each year there are more than a hundred competitions around soliciting participants from the schools, such numbers are not too disappointing. Also, although we received less than 300 projects in these four years, the actual number of projects done in response to the competition was probably much greater. Some schools screened their students' work first before sending the good ones in. An encouraging sign is the increasing trend in the number of entries throughout the past four years.

4. Evaluation of the competition

Despite the various types of weakness and imperfection observed from the entries, we find the competition has, throughout the past four years, led to undeniable achievements.

First, undertaking a statistical project on a society-related aspect has brought the students out of the classroom so that they may have an opportunity of studying a problem (problems) in the society in which they live. This achievement is particularly valuable as Hong Kong education has been criticised for being too academic and examination-oriented, and Hong Kong students for not being sufficiently socially conscious.

Second, Hong Kong students are often accused of relying too much for their academic success on rote memory, being generally weaker in applying their academic knowledge to real problems. Weaker still is their ability to see various subjects as a coherent body of knowledge. Undertaking a statistical project requires the students to integrate their knowledge of, say, mathematics, statistics, computing studies, economics, public affairs, geography, and possibly other apparently unrelated subjects as well, for the study and solution of real-life problems. This valuable aspect of education is not provided by the normal school curricula.

Third, problems in projects are usually of the open-ended type. Students used to handling textbook problems will, through the projects, learn that, in real life, problems do not always have unique answers. They will therefore be required to explore their own resources and to develop their best solutions. Again, this aspect of education is realistic, and is most satisfactorily provided through projects.

Fourth, through supervising the students' projects, listening to the briefing sessions, and discussing the projects with adjudicators, teachers are able to identify the common mistakes and weaknesses of their students. The projects can then be further analysed to summarise and classify common mistakes which will provide vivid examples on the use and misuse of statistics under the high school curriculum. The Hong Kong Statistical Society is aiming at compiling a booklet on these examples to provide teachers with additional teaching material.

Fifth, the projects themselves (as distinguished from the competition) provide extremely useful teaching materials, not only for mathematics and statistics, but for many other subjects as well. Thus, the topics of various projects can be used to illustrate the usefulness and social relevance of statistics and give good motivation to the students. The computer outputs can be used as good and bad examples of computer

usage. The collected data and the results of analysis can provide more up-to-date subject matter for the study of economics and public affairs than most textbooks can provide. The projects, therefore, enrich teaching materials and provide valuable case studies.

Finally, participation in projects provides the students with an excellent opportunity for team work.

On the other hand, there are some points which can be improved on in future competitions.

First, students need to be convinced that the projects should be problem-motivated rather than data-motivated. Discussion with many participants of the recent competitions showed clearly that most of them started by holding onto some available data sets and then building up a theme of study by analysing and interpreting the data. A more realistic approach should be to identify some problem(s) of interest first and then to secure the required data from diversified sources for the investigation of the problem(s). We found that not all projects used adequate amounts of data to support their arguments. The data-motivated approach, rather than the problem-motivated approach, affords an explanation of the students' weakness in this respect.

Next, as "project" is not a stated teaching strategy of the secondary school education in Hong Kong, students normally need guidance from their teachers in undertaking their first projects. Unfortunately, not all the participating schools seemed to have provided such guidance. Although the Organising Committee of the competition realises this, and organises a seminar/briefing session for intending participants and their teachers before the commencement of the competitions, such seminars, being held only once a year, cannot completely replace the guidance of teachers, particularly in matters specifically related to students' personal abilities. We hope that teachers will understand that giving guidance to their students does not necessarily mean interfering with the students' initiative and originality. In particular, it may be helpful to the students if teachers can demonstrate the distinction between statistical and non-statistical projects and give examples of properly written conclusions.

Finally, the proportion of schools participating in the competition has remained rather small (less than 10%). We attribute this (justifiably, we believe) to the examination pressure which teachers and students alike have to sustain and the apparently unimportant position which statistics occupies in the school curriculum. Fortunately, with the revision of the curriculum of Forms 6 and 7, a new subject "General Mathematics and Statistics" will be introduced in a few years' time, and we hope this will give impetus to statistical education in Hong Kong as a whole.

References

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