Projects and Practical Work in GCSE Statistics

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1.   GCSE Statistics

In 1988 the GCSE examination was introduced in England and Wales to replace the dual system of examinations taken at age 16 years, GCE (for the most able) and CSE (for the majority). Certificates are awarded in individual subjects. Most school pupils take from six to ten subjects, nearly always including Mathematics and English. One of the many subjects on offer is Statistics which entails both written examination and course work. GCSE Statistics is normally taken as a two-year course (age 14-16) although some candidates take it the year after sitting their main GCSE examinations, as a one-year course (age 16-17). It is very much a minority subject (perhaps taken by 1% of all school candidates).

Currently there are five separate examination boards for England and Wales providing five different syllabuses. However, in 1992 all five will combine to provide a single syllabus, to be first examined in 1994. A working party of the *Joint Rationalisation Group for the GCSE Boards* is currently devising the new syllabus. Final agreement has not yet been reached although much progress has been made.

The philosophy pervading GCSE Statistics is typified in one board's *Notes for the Guidance of Teachers* for the 1991 examination:

> "Statistics is essentially a practical subject ... A basic principle of statistical work is getting information from an appropriately drawn sample and inferring results ... It follows that no course in statistics will convey the essence of the subject if it does not include practical work ... It is hoped that the bulk of the teaching of this GCSE course will be based on practical work." (MEG, 1989)

Other boards express similar sentiments. It is very clear that for all boards the *whole* GCSE Statistics course, and not just the project work, is seen to be *practically orientated.* It is important that the coursework shares the same ethos as the rest of the course, otherwise it tends to be treated as a peripheral aspect and undervalued.

2.   Coursework requirements

The coursework component forms a significant part of every board's syllabus, from 25% to 40% of the total assessment. The amount of time to be devoted to the coursework is in proportion to its weighting. Generally the boards are non-committal about the volume of work expected, but one suggests that "written reports on the projects *taken together* should be in the order of 2500 to 5000 words in length"; another states that a minor project "should take about 6 hours to complete" and have about 12 A4 sides of report, with a major project having twice these figures. These times seem gross underestimates. Boards differ also in either weighting all projects equally or, more commonly, differentiating between *major* and *minor* projects. The *minimum* number of pieces of work required varies from board to board, ranging from one to three. The maximum number varies from three to five although one board sets no upper limit.

Requiring only one project may make the life of the teacher rather easier but it is not so helpful educationally for the pupil, for several reasons: a single project limits the range of statistical topics which can be covered; pupils are "putting all their eggs in one basket"; pupils cannot readily learn from their mistakes and improve in a subsequent project; pupils may find it difficult to maintain interest and momentum.

On the other hand pupils are under great pressure with many calls on their time, as are their teachers. The open-endedness of one board and the "up to 5 projects" of another may make too great a demand on pupils. Similarly the requirement of 3 or 4 projects of equal status can be very burdensome as pupils feel that every piece must be a major project. Perhaps the ideal solution is to give a choice between "*one major and two minor projects*" and "*two major projects*".

Coursework common to two curriculum areas could be most helpful even if the time saved were rather small. Group work raises great problems for assessment and seems an unlikely way forward except for a few particularly successful schools. Boards vary in their enthusiasm for it.

3.   Suggestions and actual projects

Some suggestions for projects supplied by a board (MEG, 1989) are:

(i)   Correlation: (a) Age and weight; (b) Attendance at a football club and team performance.

(ii)   Comparisons: (a) Do oranges from one shop weigh more than those from another shop even though they cost the same? (b) Prices of toothpaste.

(iii) Time Series: (a) Weather; (b) Population trends relating to your town, district or school.

(iv)   Find, using a questionnaire, the views of your school on reading or entertainment preferences.

(v)   Obtain and analyse data related to reaction times (perhaps using a computer).

(vi)   Select three different kinds of statistical presentation from published Government statistics. Discuss their merits and suggest other ways in which the data might be presented.

(vii) Open a telephone directory at random and count how many numbers end in 1,2,3,4,5,6,7,8,9,0 and discuss your results.

(viii) A species of beetle reproduces as follows: 30% of females die without female offspring; 40% of females have one female offspring; 30% of females have two female offspring. Simulate the female descendants of 10 females up to the fifth generation and comment. Try varying the proportions.

Some suggestions from another board (NEA, 1989) are:

(i) conducting a school census;
(ii) conducting an opinion poll;
(iii) comparing urban and rural life patterns by studying two data files for the 1861 survey;
(iv) designing a Fruit Machine to conform to the Lotteries Act;
(v) running a weather station.

Unfortunately, schools tend to take board's suggestions for projects quite literally and impose these on pupils and then rather dull projects are often produced. (For ideas for projects and practical work see the list of references.)

The list of projects below, which were all submitted to one board in the past two years, to some extent contrast with the "official" suggestions given above:

How old are cars when they are scrapped?
How does petrol consumption of a car vary?
Who uses which forms of transport and why?
How can the operation of traffic lights be simulated?
How do newspaper advertisements vary with paper and season?
What determines the price of a secondhand car?
How does memory vary with age?
How does tiredness affect performance (on a computer game)?
Does factory output vary with the weather?
Basketball scoring ability and height.
School absences
Baked Beans.

4.   What makes a good project?

If we take an apparently banal topic - such as Baked Beans - must we expect a banal project? The answer is NO! It is surprising how much good statistical work can be done. For example:

(i) The relationship between brands, sizes and prices.
(ii) Why do people buy particular brands?
(iii) Can people tell the difference between brands?
(iv) Do people *think* they can distinguish brands by taste?
(v) Are sales and opinion affected by advertising?