THE IMPACT OF COMPUTERS ON SCHOOL STATISTICS TEACHING

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In a short talk it is only possible to touch the surface of the major changes that readily accessible computers, particularly microcomputers, will have on the teaching of statistics. Already it is possible to see changes and even more will take place as computers become more available to the pupils. Most of the changes that have taken place so far have been because computers have been available to the teachers, and perhaps to a select few only of the pupils. Again, particularly in the UK, it is clear that the initial changes have taken place in the teaching of statistics to older pupils and on more specialist courses (with some exceptions as described below), but the effects are now beginning to be felt in the earlier part of the school curriculum.

I have picked out four areas in which computers are changing the teaching and learning of statistics and I have illustrated them with screen dumps from programs that are currently available in the UK. The four areas are Content, Approach, Emphasis and Understanding.

Content

The growth of computers has affected the content of syllabuses by introducing new topics and by removing (or at least making much less important) older topics.

The new topics include such things as stem-and-leaf diagrams, which can more easily be sorted by computer and the data on file can be real data and readily updated. They have also encouraged the use of data bases (such as those from census returns) and the ability to sort out relevant data from these bases. This has encouraged the use of more open questions (such as "What would be the effect on Manchester airport of removing the British Airways freight traffic?"), which require high levels of skill to answer, with the requirement to identify which information, and in what form, would be relevant to the question.

Because of the power and speed of the microcomputer, following the trend set by the pocket calculator, the skills of calculating simple statistics such as the mean and standard deviation etc are nowhere near as important as they used to be. In particular the use of linear change of scale, with working mean and class intervals, to make the arithmetic easy are not now needed.

The fitting of distributions to data, which used to be very time consuming – for the normal distribution – can now be done very quickly and the emphasis has moved towards identifying which gives the best fit and whether the fit is good enough.

Approach

The computer is changing the approach to teaching and learning statistics in many ways. It positively encourages students to explore what will happen if some data or parameter values are changed. We have therefore a greater reliance on simulation, with the possibility of changing assumptions to make the simulation more realistic. This approach encourages the understanding of probability distributions as models.

Data can now be stored and edited, so the approach has changed towards using real and larger data sets.

Many of the rules of thumb on approximations can he investigated more carefully and shown to be fairly arbitrary. So, for example, the appropriateness of using the normal distribution to the binomial can be examined for different values of n and p. The continuity of change is thus shown and the arbitrariness of any such rule as n > 30 for p near 0.5 can be seen. The emphasis moves towards the level of approximation that might be acceptable for a particular purpose.

Emphasis

Since the computer can carry out calculations quickly and accurately there is much less emphasis on calculation and more on interpretation. For the same reason there is less need to get simple data sets and a greater emphasis on real and large data sets. This also leads to a greater emphasis on reading tables of real data (as well as the ability to identify the appropriate information mentioned above). The availability of microcomputers for pupil use has also increased the emphasis on the need for understanding basic algorithms so that the pupils can write their own short programs (usually in BASIC). The excellent graphic facilities available on microcomputers have served to emphasize the use of good graphics in displaying data, and consequently the need of pupils to be able to read these displays. The importance of pupils being able to draw such graphics for themselves appears to be decreasing.

Understanding

One of the major effects of the availability of microcomputers is to increase the scope of getting an intuitive understanding of statistical processes by practice and example. This can be thought of as getting a feel for what is happening, or for what is appropriate. For example, how do you get a feel for the appropriate length of a class interval for a histogram on raw data OR how do you compare two distributions OR what is the meaning of percentiles and how can they be used?

Some of these ideas are basically statistical and practical with no formal rules or underlying mathematics. Some do have an underlying mathematical explanation and one of the purposes of the computer simulation may be to give insight into this mathematical structure so that the pupil will more

readily understand and accept the mathematical proof when it is presented (if indeed the pupil ever reaches the point of needing this level of understanding). This same type of program can be used to give insight into processes which the pupil may never understand mathematically. This can mean that the pupil can use formulae, previously understood only at a superficial level by rote learning, with some degree of competence and understanding.

With the growing availability of good software, and the more readily availability of computers for pupil use I expect the trends indicated above to accelerate and other changes to come which at present we can not foresee.