Graphic calculators in Leeds high schools:

summary report of a collaborative research project from a team of Leeds secondary mathematics teachers and Leeds University mathematics education staff.

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This project was initiated because of the hunch that large screen, 'advanced', graphic calculators were not being exploited to their potential for learning mathematics in the 11-18 age range. In order to find out about pupil provision and teacher use we surveyed secondary mathematics departments in Leeds LEA high schools.

Graphic calculators are relatively cheap 'ICT' and in several countries, Scotland, Austria and Australia for example, teachers are being supported to use this technology. In England generally and in Leeds LEA particularly there is no co-ordinated support for secondary mathematics teachers learning to use graphic calculators as part of their mathematics teaching. Our project aimed to find out the extent of graphic calculator use and the reasons for their use or non-use in local high schools.

We gathered information from all bar one of the LEA's high schools from our initial questionnaire and obtained teacher interviews from about three-quarters of the schools. We found a wide variation. The key factors which contributed to use were:

- Expertise within mathematics department
- Regard for graphics calculators: as learning aides from maths staff and as ICT from senior staff
- A critical mass of post 16 or higher GCSE students

The barriers to use were predictable:

- Lack of time to learn how to use the calculator and how to teach with it
- Concern over recent exam restrictions
- Resources: priorities and perceptions

The pressures that teachers are under are well known, and whether to use or not use graphic calculators is a small issue compared with the shower of initiatives that they have to deal with. Teachers use graphic calculators when they have a certain level of confidence with the machine, can understand how much investment they'll have to put into teaching the pupils how to use it before they can be used effectively in learning and are supported by department or school. Sometimes teachers new to using graphic calculators as a teaching aide can be drawn into using them if there is a reliable, knowledgeable person available to troubleshoot. Teachers who used graphic calculators themselves as learners seem to be relaxed about using them as teachers. The other group of confident graphic calculator teachers are those who have been using them since they became available. There does not seem to be graphic calculator-specific inset available or demanded. It is worth noting that the new Mathematics Strategy for KS3 gives many examples of learning activities with a graphic calculator specifically (i.e. not a computer graphing package).

As an aside, we found that the 'gifted & talented' funding was in a few cases being used to support development of graphic calculator use through the purchase of a set of calculators. This indicates an awareness that these relatively inexpensive portable technological devices can be used in a curriculum-enhancing way. The commercial companies (e.g. Sharp, Texas Instruments, Casio) which manufacture graphic calculators also provide curriculum materials. Many of these materials are nowadays aimed at less-highly achieving KS3 students. These two observations together suggest that graphic calculators could have a valuable role in curriculum enhancement throughout the school as also reinforced by the KS3 Mathematics Strategy.

Looking over all our data there is a sense that graphic calculators are seen as rather tired technology: an eighties item with little new potential. This is not an accurate appraisal – the more recently developed sensors, for example, give a valuable opportunity for cross-curricular work (data generating in, say, geography or science, 'handled' in maths) and overhead projector screens are invaluable in whole class teaching. It is the perception of graphic calculators which is a key aspect of whether pupils get the opportunity to work with them. There were cases where senior management's perception of ICT was computers only. In such cases, the mathematics department had to be confident that graphic calculators deserved a share of its limited money and teacher-energy budget.

Students who were studying A/S or A level were encouraged to buy their own in the more affluent schools. With bulk purchase, the price was about £25. Some teachers left it to the students themselves to learn how to use the machines and there were suggestions that students' confidence outstripped their competence. The sense is that the post 16 provision of graphic calculators is rather ad hoc: those who can afford them get on with it, but, especially with the new P1 assessment arrangements, there is less direct teaching of how to use a graphic calculator at this level. Some students will have had their own graphic calculator since KS4 and perhaps it is difficult to incorporate explicit teaching in Y12 when there are already experts in the class. This contrasts with reports of whole class teaching with graphics calculators in KS3 where no pupil-expertise existed: classes could be taught relevant functions quite quickly, given time to 'play' with the machine and taught the relevant maths effectively. There had to be firm management techniques in place when class sets of graphic calculators were used in the lower school; some schools were that worried about security they declined to use the resource with pupils who might well have benefited.

This short summary aims to give the impression that there is expertise in graphic calculator teaching within Leeds LEA high schools, but it is limited. Some mathematics departments support teaching with graphic calculators: schools with buoyant A level numbers continue to use them as a tool, but with caution given the restrictions on exam use. Some maths departments have a vision of graphic calculator use as a supplementary mathematics ICT across the age and attainment range and this is supported by recent curriculum initiatives.

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