

More Than Just a Calculator

Nevil Hopley, Head of Mathematics at George Watson's College, Edinburgh, describes his experience of using and designing programs for graphic calculators.

The current generation of graphic calculators can do much more than crunch numbers and plot graphs. Even training students to do these commonplace tasks with them, in an effective and knowledgeable way, can take a couple of years. It is not surprising that most students are not fully capitalising on the investment that they have made in handheld technology.

Knowing exactly how to use a graphic calculator should be one of the goals whilst teaching maths, especially as graphs and calculations are what students do every day in classrooms around the UK. However, calculators can be used in other ways to help students learn about maths and these ways do not require knowledge of how all their features work. By this route, great steps can be made in a short time.

The processors inside the current generation of graphic calculators are the same as those in some of the home computers from the 1980s. Graphic calculators are really handheld computers. With the right software program, maths lessons can take on a whole new dimension that allows the computer room to come to the maths room. Programs can easily provide differentiated tasks enabling students to tackle challenges and concepts at their own pace.

Since 1998 I have developed a collection of such software for the Texas Instruments range of graphic calculators. These have been extensively trialled in lessons and are already used in many other schools across the UK.

The programs help students develop a whole range of skills covering shape, number, algebra and even logic. To use them requires no knowledge of how calculators are programmed or familiarity with their in-built features. In many ways they are switch-on-and-go tools, great for use with students from P7 to S6,

and even better for busy teachers.

Many programs incorporate levels of difficulty that lead students to acquire sophisticated skills in a structured manner. Some have built-in timers so that they can try and beat the clock. A selection of programs, *Equation*, *TimeUp* and *Integral*, were featured (alongside others) in a two-CD resource pack, *Using Graphic Calculators*, sent to all Scottish secondary schools by Learning and Teaching Scotland in 2003.

Equation – as the name suggests – is a program which helps students understand the principles of equation solving in a non-threatening way. Starting from 'classic images' of barrels and weights on either side of a balance, it progresses over 12 levels through non-integer solutions to full linear algebraic representation with both positive and negative coefficients. When students answer three questions correctly in a row, they progress up a level. Answer two consecutive questions wrong, and they go back down a level – guesswork is very much discouraged!

Many programs generate random questions according to a designated template. This leads to students discussing not what the answers are, but rather what the right method is.

Students can choose to keep their progress private or share it with others – whichever they are most comfortable with. Teachers can look over students' shoulders and quickly see from the information that is displayed on each screen how they are progressing. Furthermore, some programs keep detailed score



sheets of how many attempts were taken by the student to answer a question. The program *The Ultimate Non Calculator Challenge* even requires students to go back and do their corrections at the end!

If you are new to graphic calculators and would like free training, this is available via Texas Instruments' T3 organisation (Teachers Teaching with Technology). If you would like to borrow a class set of calculators to try things out, TI runs a free loan programme.

Free samples of programs, and tips on using calculators at www.CalculatorSoftware.co.uk

Free T3 training for TI graphic calculators – e-mail t3@ti.com

Free loan of TI calculators – e-mail ti-cares@ti.com or telephone 020 8230 3184

National Qualifications Online www.LTScotland.org.uk/nq/nq-library

Graphic Calculators for Int 1, Int 2 and Higher. These program downloads, originally located on the Scottish Virtual Teachers' Centre (SVTC) website, are now available in the NQ e-library to accompany the PDF documents exemplifying the use of graphic calculators. The resources are for Casio fx-9750, Texas TI-83 and Sharp EL-9600.