Dynamic Graphing B

National Centre for Excellence in the Teaching of Mathematics

A staff development workshop on using digital technologies for a group of teachers

This is the second of three workshops on dynamic graphing.

What I did
I chose these tasks to show delegates ways that Dynamic Graphing Software can be used to enrich the solution of problems and focus on mathematical thinking rather than just calculations or drawing graphs and charts. Delegates came with a variety of software packages available to them and were encouraged to use the package of their own choice, as well as seeing demonstrations of some of the features of a packages that were unfamiliar to them.

What happened
Delegates found that some packages were more suited to algebraic graphing and others more convenient for data handling.

Reflection
Delegates needed time to explore the ideas and try them using their chosen dynamic geometry software. Showing a variety of dynamic graphing packages can be useful for delegates but care needs to be taken not to cause confusion.

Session outline

Aims for the session:	This workshop aims to enable delegates to: • *To create and make links between multiple representations of functions in algebraic, graphical and numerical forms within purposeful problem solving contexts.* • *To develop more dynamic graphing skills in order to use dynamic geometry as a tool to support the solution of algebraic equations within a problem solving context.* • *To learn how to create graphs and charts from data sets using dynamic graphing software in order to focus on appropriateness, interpretation and use of charts and diagrams.* • *To consider the features of successful teaching approaches with respect to choice of graphing software, task design and pedagogical considerations.*
Resources:	• *Autograph;* • *TINspire;* • *The Mathematical toolkit* • *Fathom, Tinkerplots* • *[Geogebra, GSP and Cabri-2D];* • *Data samples from Census at school website*
Session description	*Dynamic graphing software enables the teaching and learning of sequences, functions and graphs and statistics to be approached in a more exploratory way.* *Dynamic Graphing software will be used as a tool to investigate some practical problems. In particular the software will be used to obtain approximate solutions to poylnomial equations.*

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Who is session aimed for?	*Secondary ITE tutors and LA consultants / advisors who will be leading similar sessions for trainees and teachers.*

Time	**Activity** *i.e. what are the workshop delegates going to be doing?*	**Key questions to ask** *i.e. what is the workshop leader going to be doing/saying?*
14:30 – 14:55	**Brief comparison of different software packages and their strengths:** • Tinkerplots • TINspire • Autograph • GeoGebra	Does is matter which software package you use? Does the task make a difference to which package you might use? How might you use dynamic graphing to stimulate mathematical thinking How can the software be used to stimulate the posing of questions by pupils and support pupils in answering them?
14:55 - 15:20	**Use dynamic graphing software to estimate solutions to equations arising from problems:** ***Max Box:*** Present the problem: Make an open box with the largest volume possible by cutting a square from the four corners of a: • 10cm square • 20cm square • 30cm square? • any square? – is there a pattern or a rule? • an A4 sheet of paper? **Discuss** how students might start off without much ICT (perhaps a calculator) and how the use of dynamic graphing software could be used to model the problem by: ▪ Deriving the formula for the volume from the 10cm square in terms of x and drawing the graph ▪ Find the max volume by: • Estimation • Graph tools i.e. max or f'(x)=0 ▪ Extend to other size squares and use variables when entering the equation to start to generalise	How would expect students to tackle this problem? What resources would you make available? How many different ways can you find a solution to the problem using the technology? What new representations are offered by the technology? How might the technology support the further exploration of the problem?
15:20 – 15:50	**Handling Data** Look at how to entering data manually or imported large secondary data sets from other sources (e.g. sample of data downloaded from Census at School website)	How does the use of graph plotting software instead of pencil and paper change the lesson?

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	Focus on meaning and understanding Look at data collected by Census at School from UK and South Africa and heights of students; create a dot plot of raw data; **predict** the box plot – draw prediction over dot plot, then use graph plotting software to check prediction and discuss Look at Handling Data cycle Participants to work on a short investigation using some of the data available from CensusatSchool website and create appropriate statistical graphs and charts in their chosen software.	What will the box plot look like? Where will the median be? Etc Tutor to support and bring group together from time to time to show features of specific dynamic graphing software e.g. grouping data; tables of values; writing a report including graphs and charts created. Give participants time to explore their software in the context of a statistical investigation.
15:50 – 16:00	Plenary – next steps	When would a shared image on the IWB be used and when would students have hands on access to the ICT? How would you enable students to have sufficient ICT skills to make effective use of the package? What other familiar problems could be investigated using these resources?

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Follow up:	**Useful websites for information and tutorials about dynamic graphing software** Autograph http://www.autograph-maths.com/ http://www.tsm-resources.com/autograph.html Autograph tutorial videos http://www.tsm-resources.com/videos.html Geogebra (free to download) http://www.geogebra.org TI-nspire http://education.ti.com/html/nspire_uk/ Omnigraph http://www.virtualimage.co.uk/html/omnigraph.html Geometer's SketchPad http://www.dynamicgeometry.com/ Census at School website http://www.censusatschool.org.uk/ Census at School Booklet http://www.censusatschool.org.uk/resources/relevant-a-engaging-stats Census at School Random Data selector http://www.censusatschool.org.uk/get-data/random-data-selector NRich reaction timer http://nrich.maths.org/6044
Resource	A systematic review of the use of ICTs in developing pupils' understanding of algebraic ideas (EPPI-Centre, Social Science Research Unit, Institute of Education, University of London).

This material was used in one of the series of CPD workshops that formed the four day course 'Leading and supporting the development of digital technologies in mathematics'. This course, delivered in two sets of two-day sessions, was funded by the NCETM and written and tutored by members of the Association of Mathematics Education Teachers (AMET) and National Association of Mathematics Advisors (NAMA). Over 50 people followed the course with representatives from the ITE sector, Local Authorities and teachers from schools (primary, secondary and further education).