JOINED UP THINKING

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A group of students must *"know how to determine the equation of a straight line in the form y = ax+b from its graph"* (Intermediate 2 Mathematics, SQA, 1999). So starting with the particular and moving to the general, we begin with an example...

> *"It's hard to measure the length of a winding road on a map. Can we estimate its length by counting how many times it crosses a gridline?"* We each try out the idea by laying different lengths of string randomly on 1 cm squared paper and collecting data. *"A graph may be helpful."* We draw graphs by hand and, using a transparent ruler, we fit a line. *"The line doesn't quite go through all the points but it's the best fit we can find."* Find the equation of the line. Laurence gets $y=1.1x$. *"The equation doesn't quite fit all our data ...but it's the best fit we can find." "We all got more or less the same equation: y=1.25x, y=1.1x, y=1.2x." "Why weren't they the same?" "Why is it a straight line again? Oh yes, all the pairs of numbers fit the equation / lie on the line".* Natasha says she was told that a line of best fit couldn't go through the origin. *"But a 0cm piece of string must cross 0 gridlines".* We agree that length = crossings × 1.2 (roughly). The graphic calculator gives the equation of the line as $y=1.26344086x+0$. *"That looks different – oh no, if we round it's about the same."* We try to predict the length of a string with 22 crossings. *"So how far is it from Edinburgh to Perth on the M90?" "We can often fit data to a straight line in this way. It allows us to predict..."* (The poster includes illustrations of this activity)

From the particular to the general...

Some teachers like teaching (school) Mathematics because it is tidy and complete and logical. The experience of this group suggests that learning Mathematics is neither a linear nor a tidy process. Its very untidiness pushes it forward. *(Why is the equation on the GC different?)* Learners work to assimilate new ideas to the concepts they are building *(eg a linear relationship can be used for prediction)* and accommodate the concepts to make sense of the inconsistencies they find *(eg. a best fit line **can** go through the origin).* Using a holistic approach to bring together different concepts motivates the learner to tidy up, reconcile, rationalise, understand better. It is not possible to 'tick off' the linear relationship as completely 'understood' by a learner. Intelligent learning (Skemp,R.(1987) Psychology of Learning Mathematics) involves building a network of links between concepts. This is an ongoing organic process.

By the way...

We also covered co-ordinates, graphing, gradient, ratio, decimals, rounding, algebra, substitution, why Maths is a powerful language, why Maths might be worth learning... And we joined up our thinking.