



MIND THE GAP

New strategies for teaching and assessing the full data handling cycle

Friday 6 July 2007, University of Reading

Susan Starkings opened the meeting by emphasising the practicality of Statistics (particularly the data handling elements) and its value as a discipline in the real world.

She feared that given the data handling project within GCSE Mathematics was about to be deleted it would be very difficult to properly assess students' statistical skills and knowledge. She also feared - a view shared by others including RSS Centre for Statistical Education colleagues - that concepts such as interpretation and design if not assessed might - as often happens with topics which are not assessed - not be taught at all in future.

She explained that although coursework had not been well received by the mathematics teaching community due to time constraints (a participant emphasised that issues around assessment had been the main issue: marking criteria were unclear, different moderators gave out different messages etc), the loss of the project design aspect of coursework and the interpretation and comprehension skills it helped to develop would leave a major gap in the curriculum.

Susan noted that whilst the QCA-RSSCSE Review of Statistics and Data Handling had begun before the deletion of coursework had been announced, it was very fortuitous that the team's focus on different ways of assessing and teaching Statistics and Data Handling within GCSE Mathematics had raised a new approach for assessment of the data handling cycle at a time when fresh thinking was needed.

The problem solving approach: new teaching and assessment models and strategies (Liz Gibson, RSS Centre for Statistical Education, RSSCSE)

The Smith Report ('Making Mathematics Count') in 2004 had recommended that more time should be restored to mathematics for the reinforcement of core skills such as algebra and geometry and a possible repositioning of Statistics and Data Handling within the overall 14-19 curriculum as a subject in its own right which would be increasingly integrated with other subjects. The QCA-RSSCSE Review had followed on from the Smith. Liz Gibson described the main thrust of the QCA-RSSCSE study which had been to review the statistics and data handling content of GCSE Mathematics to determine what should be retained as part of the core curriculum for Mathematics and what could be beneficially seeded for delivery through other subjects, particularly science.

The QCA-RSSCSE Review's recommendations had covered:

- (i) the positioning of statistics and handling data
- (ii) an assessment of coursework
- (iii) CPD
- (iv) teaching resources
- (v) a fresh approach to teaching the data handling cycle via 'the problem solving approach'

In the first phase of the project the RSSCSE colleagues secured Mathematics, Geography and Science teachers' views. (Participants were encouraged to look out for the Review's findings which it was hoped could be published in late Summer 2007. They would be able to read some of the very interesting attitudes held by some Mathematics teachers in relation to teaching Statistics).

The main recommendation made as a result of these surveys and interviews was that Statistics and Data Handling should remain within the Mathematics curriculum and be supported with CPD and teaching materials. Areas where teachers said resources would be particularly useful were in measures of variation and location, regression and time series and inference from data.

RSSCSE colleagues had then focused on developing and trialling new resources and new assessment methods. The resources had been designed to move away from teaching techniques to encouraging a holistic view of statistics and handling data, engaging pupils with problem solving - encouraging them to achieve a resolution in the way a professional statistician does - and the ability to transfer skills to real world situations including via other subjects e.g. geography and the sciences.

Underpinning the new approach was a 'redesign' of the data handling cycle and taking a 'problem solving approach' which clearly identified the stages in the resolution of problems from planning to collecting to processing and discussing.

At planning, a decision is made about the problem to be solved – the problem is identified, a question agreed on and thought given to what data are needed, at collection stage, the data are collected, at processing stage, the data are examined and via different kinds of representation made easier to understand and then at the final discussion stage, there is a report back on what has been found, the data are interpreted and going back to the initial question, a comparison is made with what was expected, thus brining the cycle full circle.

Liz shared some of the new resources, starting with 'How safe is the area you live in?' a project approach to answering questions about local crime. The cycle in this case guided students from a planning stage question concerning how safe a local area is, to deciding which data should be collected to investigate this, to use of the crime data collected at processing stage and then presenting and interpreting data and drawing conclusions about how safe an area is.

The existing library of resources included:

- how safe is your area?
- crime scene evidence
- virtual reality gloves
- where's worst?
- how far, fast and high?
- how old is your height?
- what's in your bowl?
- world population

All used a combination of a teachers' overview, powerpoint presentation with embedded notes for teachers and pupil worksheets and downloadable data sheets. Liz also ran briefly through a pupil worksheet which helps with formative assessment, prompting and moving students forward through the exercise.

RSSCSE colleagues had used a teachers' workshop in 2006 as a forum for generating new ideas for resources – many of the ideas for the above resources were raised on that day. Neville Davies called for more ideas and for teachers to work with the Centre in developing new resources.

Teachers were asked the question which the RSSCSE had tackled via this project. When coursework disappears, examination questions would, of course, change too. What sort of questions would test the problem solving approach?

RSSCSE colleagues' research had led them to believe that the best approach would be to test the problem solving approach via an interactive and time constrained task which is tackled online and they had, indeed, developed an online assessment tool for this purpose.

Their plan was to take this forward by securing DFES approval (QCA colleagues had reacted positively to the problem solving approach and to the assessment tool recommended. As the Authority did not have funds itself for these sort of developments it had recommended the approach to the DFES (now the DCSF). Matters were, at the time of the meeting, in the hands of colleagues at the Department for Children, Schools and Families.

In summary, RSSCSE colleagues identified a way forward.

They were very keen to share the detailed outcome of the Review including the surveys which, they reported, produced some very interesting results. The QCA had approved a presentation they were planning to undertake at a teachers conference in Portugal. Thereafter, they would be awaiting a QCA-co-ordinated launch of the Review report.

Neville further explained that he was very keen to see this project deliver tangible outcomes. The post 14 Mathematics Inquiry had underlined the need for no more long reviews which produced recommendations but which did not then lead to tangible results. He was very hopeful that this project would be permitted to run through to actually delivering on its proposals.

Liz further explained that a further aspect of the project, the development of a Wizard which would allow teachers to create their own resources in the style of the RSSCSE designed ones, was nearly completed. Liz and John took the opportunity to encourage participants to experiment with a working version of the Wizard at www.rsscse.org.uk/wizard. All participants on the day had been allocated an individual code found on their copies of slide presentations which allowed them to access the existing resources and to undertake some of the exercises.

Post-presentation discussion

Some teachers felt that more should have been done in the past to address the assessment issues relating to coursework.

The overall suggestion was made that Statistics could perhaps become part of the Functional Mathematics strand now being considered within Mathematics GCSE 1 (possibly up to 40% of GCSE 1 might be Functional Mathematics) of the planned double award Mathematics. One teacher participant thought that this could well be assessed electronically.

Neville Davies said that he would be interested in seeing this given serious consideration.

Another teacher who did not usually teach in the UK asked whether there were any data protection issues around the data used in the new resources developed. John Marriott of the RSSCSE confirmed that the data used were all freely available and in the public domain. The crime data in the example considered in detail, had all been drawn from the Office for National Statistics webpages.

Neville Davies said that if anyone felt discouraged when trying to work with primary data, they were strongly encouraged to consider using the CensusAtSchool webpages – <http://www.censusatschool.ntu.ac.uk/> - a site where real data collected by teachers and children can be found. Once collected the dataset could be 'processed' by the RSS Centre for Statistical Education staff and returned to the school in anonymised and immediately useable form as well as posted on the site for use by other users too.

Assessing the full data handling cycle (Ken Barley, OCR)

Ken explained that he held the full-time post of Chair of Examiners at OCR and held responsibility for chairing committees which determine papers and others which determine grades. He had been involved in aspects of state education for 30 years including as a teacher. He felt compelled, however, to emphasise that neither he nor his examination board nor (he thought) any other board had all the answers.

A scenario was described in which approaches to assessment seemed to have come full circle from O, A levels and CSEs to coursework, GCSE, then Data Handling Coursework, the deletion of coursework and the likely plan to return to solely examination-based assessment. We were all asked to consider when a quoted statement might have been made:

“in the longer term, all forms of pupil assessment should involve an increasing degree of teacher professional judgement”

....most thought that it might have dated back to the early 1970s and “teacher assessment power” when teachers were setting their own Mathematics CSE papers and marking them themselves*, others thought it could have been made any time during the period prior to the introduction of the National Curriculum in 1988 when teacher assessment was still very much the norm. We were all wrong!. The quotation had been taken from a recent General Training Council document issued in March 2007 which considered how assessment might work in the future (and its impact on teacher workload).

We were reminded of the QCA online consultation which asked whether GCSE Mathematics coursework should be abolished (with the assurance that this would only happen if there were a big majority in favour). The self-selecting sample of teachers who responded voted against coursework and it was withdrawn. There were indeed various criticisms including by the statistics professional community including societies such as the RSS of the way that Statistics was handled i.e. the value of sampling when you already have all the data and the correlation of coursework marks with paper marks....however, the overwhelming view was that the consultation questionnaire undertaken by the QCA (under some pressure from the then DFES) was not the optimum - nor, by far the most statistically sound - approach to take. Of course, we all agreed teachers should have been asked ‘What is the best way of assessing AO1?’

Ken asked participants whether an explicitly separate approach to assessing the full data handling cycle was needed and whether it could perhaps be incorporated into existing structures and approaches? (*just as we might, for example, do when teaching mechanics i.e. teach the principles?*) Or was Statistics a special case given it is very much a ‘doing’ subject? (*surely mechanics, some would argue is as well*).

As an examination or teacher assessment seemed to be the main ways forward, it was worth considering the issues with both. The Tomlinson Review had recommended reducing the number of times learners are examined, particularly the repetition of some GCSE coursework assessment and had encouraged the introduction of teacher judgement (assessment) as the dominant method of assessing main learning at intermediate level and below. In the meantime, teacher assessment also held possibly insurmountable challenges concerning both centre and teacher accreditation from how could standards between one centre and another could be assured and how to monitor an accredited teacher?

The final slide was a certificate which demonstrated just one of the short courses in assessment in existence – one which led to a Certificate of Accreditation which allowed the certificate owner to provide awards (the example shown related to certification at a lower level than GCSE but nevertheless was indicative of one of the possible future paths).

* This, Ken explained, seemed to work very well for some time.....a group met once per year to standardise content and grade levels but he acknowledged that, eventually, local employers probably had some sense of centres which allocated higher grades a little more easily. He recalled the reaction of teachers to coursework when it first came in, it was considered a wonderful opportunity. In 1988 when GCSEs came in, coursework had changed a little with a view to testing the parts which examinations could not reach. Data handling coursework had been introduced in the Summer of 2003, with immediate implications for AO1 (Applying Mathematics) and AO4 (Handling Data) teachers became unclear what was required with subsequent effect on marks, although there has been ‘grade creeping’ as teachers had become more aware of what is required to achieve the higher grades.

END OF SESSIONS DISCUSSION

Participating teachers thought that the teacher assessment approach at GCSE would probably not work as the government distrust of teachers (it was thought this has been an issue in the past) would kill the initiative for all parties.

On a practical level, the approach which was put forward with the most support was the online examination. To address the possible issue of plagiarism, materials should, it was thought, be issued e.g. 3 weeks before the examination. Students would then have time to familiarise themselves with the materials which they would have to answer unseen questions on under online examination conditions on the day. (Ken drew comparisons between this approach and OCR Tasks which used to be undertaken under controlled conditions. Papers were not released until an agreed date. OCR had, he said, worked in this way at a time when some other boards had looser controls over similar exercises and had experienced problems.)

A participant asked whether anything could be learned from the Mathematics in Education and Industry (MEI) computational modules that MEI has had for a number of years? Another participant raised the fact that in Geography, the seen case-study had been a longstanding and positive form of assessment.

In the case of data handling, case studies could be posted online and accessible beforehand but questions would not be seen until the day of the examination. Acting as devil's advocate, Ken asked whether we might then not just be examining how good teachers are at guessing what the questions would be? The response to his was a very vocal 'no'....of course, experienced teachers will get better at 'predicting' the content of examinations and should not, it was thought, be penalised for doing better.

However, participants noted, the problem with pre-releasing materials in the way described is that it could only work if there were special case subjects handled in this way. At present for many students it was just one subject e.g. Geography which they had to treat differently. Perhaps if it were just Statistics which were added to this, it would not create too many problems. However, if all subjects were to be managed in this way, the situation would be untenable for students who could not spend time revising across the curriculum but would have to focus on last minute preparation for these unseen case study-type assessments.

The case for online examinations over coursework is that the former is cleaner. With coursework, teachers had had to focus heavily on reminding students how to set things out and write their report.... teachers felt that a lot of coursework had felt like an artificial trawl through an issue which had killed students' interest.

An OCR classroom assessment type approach was also considered another possibility with all work being kept within the confines of the classroom with school-run sessions leading up to the examination to ensure no disparity of opportunity between students.

Conclusions?

The session raised a lot of questions about what should replace coursework and why.

In closing the meeting, Neville Davies noted that there really was (as per the meeting title) 'a gap' created by the deletion of coursework and that it seemed as though the group of teachers present on the day thought that the way forward was for data handling to become clearly embedded within functional mathematics and to be assessed via online examination around pre-released materials.

Post meeting note: although the current GCSE Mathematics trial and pilot specifications do not include any coursework or attempt to test other than on the written examination paper, the possibility of controlled assessments has not been ruled out of the new Mathematics specifications due to be introduced for first teaching in 2010. This does not mean that Mathematics will definitely have controlled assessment, nor does it mean that any controlled assessment would relate to data handling. It does mean that not everything has been decided yet and that our points are still worth arguing.