Unit 7

Handling data in Key Stage 3

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Objectives

- To become familiar with the approach to handling data in the *Framework for teaching mathematics: Years 7, 8 and 9*
- To explore possible opportunities for handling data across the curriculum
- To interpret graphs, charts and diagrams
- To consider common difficulties in handling data

Suggested use and organisation

- All schools; whole-school training day, staff meetings or individual department meetings.
- If you are running this at a whole-school training day or meeting, staff should sit around tables in departmental groups. Where possible there should be a member of the mathematics department with each group.
- If you are running this at an individual department meeting, it may be useful for a member of the mathematics department to lead the session.
- This unit follows on well from unit 3, 'Mathematics through other subjects'. Unit 9, 'Next steps: departmental developments', follows up this session.

Resources

- OHTs 7.0–7.5
- Handouts 7.1 (three sides; one set per participant), 7.2 (four sides; one set per participant), and 1.4 or 4.3 (teachers should bring their own copies)
- Poster 'Chocolate – the facts' (one per pair, if possible)
- Copies of current departmental schemes of work and QCA guidelines where appropriate

Session outline — 75 minutes

The handling data cycle Considering the handling data cycle and the distinctive features of handling data in Key Stage 3	Talk, group discussion	15 minutes
Contexts for handling data Identifying opportunities for handling data in different subjects and possible sources of secondary data	Talk, group discussion	35 minutes
Interpreting graphs, charts and diagrams Considering skills involved in interpreting graphs and charts	Talk, group discussion	15 minutes
Common difficulties Considering common difficulties in handling data	Talk, group discussion	10 minutes

The handling data cycle — 15 minutes

Show **OHT 7.0** and outline the objectives for the session.

OHT 7.0

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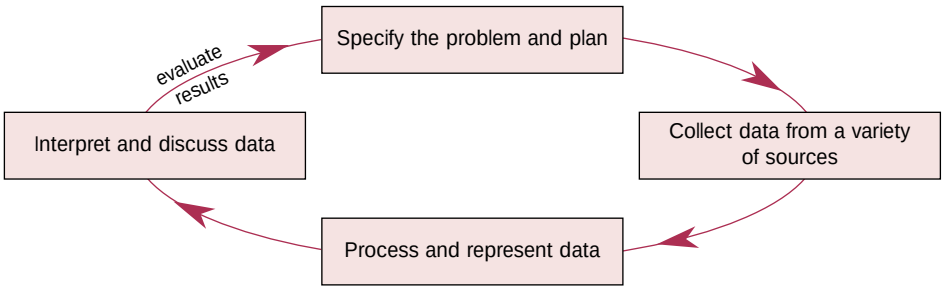
Give colleagues a few minutes to talk about any particular difficulties they have encountered in their subject when pupils are required to handle data. Note any general issues that are raised during the discussion and say that you will try to deal with them during the last part of the session.

Show **OHT 7.1** and explain that handling data is best described by this cycle.

OHT 7.1

The handling data cycle



Emphasise that pupils should experience all stages of the cycle. Opportunities need to be provided to:

- **Specify the problem**: formulate questions, decide what data should be collected including sample size, and identify what statistical analysis will need to be carried out.
- **Collect data**: obtain data from a variety of appropriate sources, including primary sources (for example, experiments and questionnaires) and secondary sources (for example, reference materials, ICT databases and the internet).
- **Process and represent data**: synthesise the raw data into summary information, including calculations of average and spread, and present the information in tables, graphs and charts which provide insight into the problem.
- **Interpret data**: make inferences from the data, referring back to the initial questions.

Emphasise that handling data is best taught in a coherent way in the context of real statistical enquiries. Say that although pupils in Key Stage 3 are often engaged in data collection and presentation in a range of subjects, too often they spend little time on the other important aspects of the cycle, particularly interpreting results.

Show **OHT 7.2** to summarise the distinctive features of handling data in Key Stage 3 and then discuss them briefly.

OHT 7.2

Features of handling data in Key Stage 3

- Basing work on *purposeful enquiry*, using situations of interest and relevance to pupils and making appropriate links to other subjects
- Placing an emphasis on *making inferences* from data, drawing on a range of secondary sources to ensure that samples are sufficiently large
- Using *ICT* as a powerful source of data, and as a means of processing data and simulating situations

Contexts for handling data — 35 minutes

Many subjects present pupils with relevant contexts in which to use their mathematics. Careful preparation is needed to ensure that the mathematical skills, techniques and representations that pupils will need to use are appropriate.

As pupils move through Key Stage 3, the cross-curricular aspects of handling data become more important. For example, a question could be formulated and the data collected in one subject, with mathematics lessons concentrating on processing, representing and interpreting the data. The other subject could then make further interpretations and consider the implications. The supplement of examples in the Framework for teaching mathematics suggests a variety of possible projects, many of them linked to QCA's schemes of work for other subjects, including science, geography and physical education, with further opportunities in history, religious education and PSHE.

Ask colleagues to look at the questions on **OHT 7.3** and discuss them in departmental groups for about 5 minutes before taking brief feedback.

OHT 7.3

Handling data across the curriculum

- Are all the different stages of the handling data cycle applicable to your subject?
- Have pupils handled data in any lessons that you have taught recently?
- Which stages of the handling data cycle were pupils engaged in?
- Which stages of the handling data cycle could pupils have been engaged in?
- Which of the distinctive features of handling data were present in the lesson(s)?

Ask colleagues to look at their current departmental schemes of work, and QCA guidelines where appropriate, and try to identify further opportunities for pupils to handle data in their own subject. **Handout 7.1**, 'Opportunities for handling data', contains some possible contexts and areas for enquiry that relate to different

subjects. As well as identifying the opportunities, participants should consider the ways in which they could engage pupils in the different aspects of the handling data cycle. Allow about 20 minutes for discussion and take brief feedback.

Remind colleagues that one of the features of handling data in Key Stage 3 is the emphasis on *making inferences* from data, drawing on a range of secondary sources. Another feature is the use of ICT as a powerful source of data.

Now ask colleagues to identify possible secondary sources of data (for example, printed reference materials, ICT databases and the internet) and how they could use them in their own subject. **Handout 7.2**, 'Web-based sources of data', contains addresses of websites for some subjects. Allow about 10 minutes for discussion. (If time is available and there is access to computers and the internet, colleagues could explore these websites.)

Interpreting graphs, charts and diagrams 15 minutes

Ask everyone to look at the **poster** 'Chocolate – the facts'. Ask them to look at the graph 'Riding the roller-coaster' and to discuss in pairs whether they agree with the magazine's interpretation of the data. They should decide what they think the graph shows and what the caption should say. Allow about 5 minutes for discussion and then take feedback.

Discuss what a 'stable proportion' should look like on this graph. Ask participants to think about the various skills that they need to use to interpret the graph and discuss these briefly.

Look at the pie chart 'Bar breakdown' and discuss briefly the representation of the data and the explanation that accompanies it.

Ask participants to consider how they could use these data or a similar resource in their own teaching. For example, this chart could be used as a focus for discussion in citizenship, or as a stimulus for non-fictional writing in English. Allow about 5 minutes for discussion and then take brief feedback.

Common difficulties 10 minutes

Show **OHTs 7.4** and **7.5** which list some common difficulties in handling data.

OHT 7.4

Common difficulties in handling data 1

- **Mean, median and mode are confused or used inappropriately**
  For example, the mean is used when referring to the average monthly rainfall in India
- **Data are represented by inappropriate graphs or charts**
  For example, a pie chart is used to represent the distances of the different planets from the Sun
- **Graphs and charts are incorrectly drawn or labelled**
  For example, the bars in a bar chart representing the votes cast for candidates in a school election are joined together or are of different widths
- **Graphs and charts are read incorrectly or interpreted inappropriately**
  For example, the vertical scale marked in thousands on a population graph is misread: 350 000 is read as 350

OHT 7.5

Common difficulties in handling data 2

- **Activities are aimless or contexts inappropriate**
  For example, vast quantities of data are collected without any consideration of the purpose of the enquiry
- **Undue time is spent on mechanical skills and there is insufficient emphasis on interpreting data and making inferences**
  For example, pupils are taught to draw pie charts or calculate a mean without understanding of when it is appropriate to use these or how to interpret them

Discuss these difficulties briefly and try to identify other examples appropriate to each bullet point. Discuss possible ways of overcoming these difficulties.

Refer to any difficulties that colleagues identified at the beginning of the session and discuss possible ways of overcoming them.

In conclusion, ask participants to note on **handout 1.4** or **4.3**, 'Priorities for cross-curricular numeracy', any issues that need further discussion or clarification with the mathematics department.

OHT 7.0

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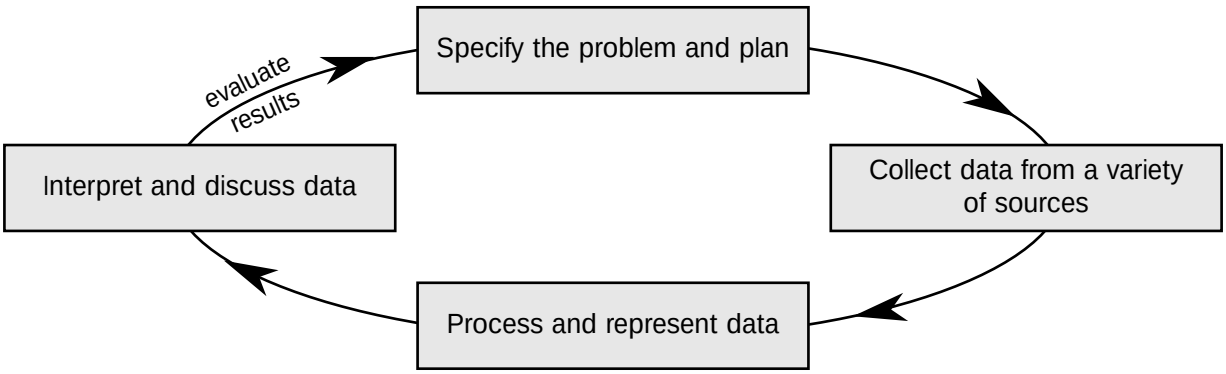
Key Stage 3 *National Strategy*

OHT 7.1

The handling data cycle



Key Stage 3 *National Strategy*

OHT 7.2

Features of handling data in Key Stage 3

- Basing work on *purposeful enquiry*, using situations of interest and relevance to pupils and making appropriate links to other subjects
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Key Stage 3 *National Strategy*

OHT 7.3

Handling data across the curriculum

- Are all the different stages of the handling data cycle applicable to your subject?
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- Which stages of the handling data cycle were pupils engaged in?
- Which stages of the handling data cycle could pupils have been engaged in?
- Which of the distinctive features of handling data were present in the lesson(s)?

Key Stage 3 *National Strategy*

OHT 7.4

Common difficulties in handling data 1

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Key Stage 3 *National Strategy*

Opportunities for handling data

Art and design

- QCA scheme of work: Unit 7B, What's in a building?
  Research buildings and examine how design might be linked to function, technological developments, fashion, local materials, cost and skills available.
- QCA scheme of work: Unit 8C, Shared view
  Research ideas and beliefs about contemporary local, national or global environmental issues.

Design and technology

- QCA scheme of work: Unit 7B(iii), Designing and making for yourself
  Investigate the styles of teenage fashion sold by leading shops and design alternatives that will appeal to 14-year-olds.
- QCA scheme of work: Unit 7C, Using ICT to support researching and designing
  Design and make a sports drink high in vitamin C that would appeal to teenagers.
- QCA scheme of work: Unit 8E(i), Producing batches
  Design and make prototype pasta products that are suitable for volume production and will appeal to the 13–19 year old market.

History

- QCA scheme of work: Unit 2, How did medieval monarchs keep control?
  When and why were castles built of stone rather than wood? Were castles built by the Normans to exert their control over Celtic lands?
- QCA scheme of work: Unit 12, Snapshot 1900: what was British middle-class life like?
  Who were our middle classes and where did they live?
- QCA scheme of work: Unit 15, Black peoples of America: from slavery to equality?
  Consider a range of source material relating to the current situation of Black American people to make a case for either black peoples still being far from equal, or black peoples now being as free as whites.

Opportunities for handling data

Geography

- QCA scheme of work: Unit 1, Making connections
  How is our place connected to other places?
- QCA scheme of work: Unit 9, Shopping – past, present and future
  Collect, record and evaluate data about shopping changes. How do out-of-town shopping centres compare to those in a town centre?
- QCA scheme of work: Unit 10, Weather patterns over Europe
  Carry out an enquiry into weather patterns and relationships using meteorological records in a suitable ICT format.
- QCA scheme of work: Unit 16, What is development?
  How will the population of a typical more economically developed country change over the next 50 years compared to a less economically developed country?

Language areas of the curriculum

- Other ideas
  Compare numerical data about prices, local temperatures, distances in the target language.
  Carry out and present the results of a survey in the target language.

Music

- QCA scheme of work: Unit 15, Song (exploring songs and the use of music technology)
  Explore different uses and contexts for songs.

Physical education

- QCA scheme of work: Unit 5, Games activities
  Collect and analyse simple data about their own and others' performances, e.g. the number of shots they have on target in a game, the number of times they hit the ball into one area of the field, the number of times they play a backhand shot.
- QCA scheme of work: Unit 22, Athletic activities
  Make effective evaluations of strengths and weaknesses in their own and others' performances. Explore tactics in jumping competitions, e.g. to what extent does a run-up help?
- Other ideas
  Analyse and compare fitness.

Opportunities for handling data

PSHE, religious education and citizenship

- QCA scheme of work for RE: Unit 8C, Beliefs and practice
  Compare membership of different faith communities in different countries.
- QCA scheme of work for RE: Unit 9B, Where did the universe come from?
  What kinds of beliefs do people hold about the world?
- Other ideas
  Investigate smoking patterns in different age groups within the UK.
  How widely available are fair-trade goods in local shops?
  Explore voting patterns in general elections. Compare the turnout in elections in different countries.

Science

- QCA scheme of work: Unit 7B, Reproduction
  Explore growth and how to measure it. Explore the range of heights in the class, and compare to data of expected heights.
- QCA scheme of work: Unit 7D, Variation and classification
  Compare data about individuals, produce graphs of variation for particular features and investigate correlations.
- QCA scheme of work: Unit 7L, The solar system and beyond
  What does the solar system consist of?
- QCA scheme of work: Unit 8A, Food and digestion
  What's in food and why is it important? Investigate nutritional content of a range of foods.
- QCA scheme of work: Unit 8D, Ecological relationships
  How do plants, animals and environmental conditions interact in a habitat, e.g. pond communities?
- QCA scheme of work: Unit 9K, Speeding up
  How fast is it moving?

Web-based sources of data

History

- http://www.liv.ac.uk/~evansjon/humanities/history/history.html
  The History Resources site contains a lot of history links, many of which contain useful data.
- http://www.historylearningsite.co.uk/
  The History Learning Site contains useful data on a variety of topics.
- http://www.bbc.co.uk/history/index.shtml
  The BBC Online History Site. Some useful pages with data sources.
- http://castlewales.com/home.html
  This site covers a wide range of topics related to Welsh castles and Welsh medieval history. There is information on over 400 different Welsh castles and their history.
- http://learningcurve.pro.gov.uk/
  The National Archives Learning Curve is an online teaching resource, structured to tie in with the History National Curriculum. It contains a varied range of information.

Geography

- http://census.ac.uk/links/
  This page provides links to the UK Census Offices and other organisations with an interest in census and survey data.
- http://www.statistics.gov.uk
  An online encyclopaedia within the official UK statistics site, StatBase allows the user to create datasets for all counties and districts according to the latest census figures.
- http://www.georesources.co.uk/indexks3.htm
  Georesources has a comprehensive list of links for Key Stage 3 geography grouped by topic.
- http://www.zephryus.demon.co.uk/geography/topics.html
  The Geography Exchange lists useful links for geography grouped by topic.

Geography (continued)

- http://inforegio.cec.eu.int/urban/audit/src/publics.html
  Urban Audit: assessing the quality of life of Europe's cities from the European Commission. Data can be displayed according to criteria or by city area.
- http://www.un.org/Pubs/CyberSchoolBus/
  InfoNation is an easy-to-use, two-step database designed for use by schools that allows the user to view and compare the most up-to-date statistical data for the member states of the United Nations.
- http://www.undp.org/popin/
  The UN Population Division site provides information about the world's population, including an analysis of trends and their best projections for future population numbers.
- http://www.prb.org/
  The Population Reference Bureau contains the latest population estimates, projections, and other key indicators for all geographic entities with populations of 150 000 or more.
- http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat
  This site contains a vast range of information about member states of the European Union on, for example, transport, environment and energy, agriculture and fisheries, population, industry.
- http://www.meto.gov.uk/
  The site of the Meteorological Office containing lots of information about weather.

Music

- http://www.billboard.com/billboard/charts/index.jsp
  Highlights of selected charts from Billboard magazine.
- http://www.dotmusic.com/charts/
  The official UK charts including top 75 singles and albums.

Web-based sources of data

Physical education

- http://www.ex.ac.uk/cimt/data/datalist.htm
  The University of Exeter Centre for Innovation in Mathematics Teaching website contains a databank which provides sets of raw data. This includes data related to athletics, such as Olympic results and world records.

PSHE, religious education and citizenship

- http://www.adherents.com/
  Adherents.com is a collection of religious statistics – references to published membership/adherent statistics and congregation statistics for over 4200 religions, churches, denominations, religious bodies, etc. This site can be used to answer such questions as ‘How many Methodists live in England?’, ‘What are the major religions of Egypt?’, or ‘What percentage of the world is Hindu?’
- http://www.rsweb.org.uk/
  Religious Studies on the Web provides a list of links for RE.
- http://www.bbc.co.uk/education/id/
  The BBC online site containing data on the effects of smoking, alcohol and drugs.
- http://www.wiredforhealth.gov.uk/
  Website managed by the Health Education Authority. Each topic has a link called ‘facts’ that provides data related to that particular issue, for example the trend in smoking amongst 11–15s from 1982 to 1996.
- www.ash.org.uk
  ASH (Action on Smoking and Health) website contains schemes of work for a half-term PSHE programme. This includes ‘factsheets’ that contain data related to smoking and health.

Web-based sources of data

Science

- http://www.sunblock99.org.uk/
  A multimedia tour of the Sun by young UK scientists including datasheets on the Sun's mass, size, distance from the Earth, etc.
- http://www.solarviews.com/eng/homepage.htm
  Views of the Solar System contains multimedia presentations, a range of data and the latest scientific information. An archive of photographs, scientific facts, text, graphics and videos.
- http://www.rogerfrost.com/
  Roger Frost's Dataloggerama focuses on the ways that information technology helps teaching, including data-logging activities, experiments and data files.
- http://www.shu.ac.uk/schools/sci/sol/contents.htm
  Sheffield Hallam University's Schools Online Science site has links to other useful websites, a 'lab' where pupils can experiment and investigate, and information for teachers.

Miscellaneous

- http://www.mathsnet.net/links/links_statistics.html
  A mathematical education site that contains a comprehensive list of links to sites containing statistical data.

Checked June 2001. This list is posted on the Key Stage 3 National Strategy Mathematics Strand website and is updated regularly.