



Guidance

Curriculum and Standards

Teachers of mathematics

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# Key Stage 3

## National Strategy

### Interacting with mathematics in Key Stage 3

### Securing progression in handling data

Course handbook



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**education and skills**

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# **Key Stage 3**

## National Strategy

### **Interacting with mathematics in Key Stage 3**

### **Securing progression in handling data**

Course handbook

## Acknowledgements

We are grateful to the teachers and pupils of the schools featured in the audio extracts and to the schools who provided pupils' scripts. They are:

| School                      | LEA             | No. on roll | FSM* |
|-----------------------------|-----------------|-------------|------|
| Furtherwick Park            | Essex           | 850         | 14%  |
| Mayflower                   | Essex           | 1700        | 4%   |
| Coleridge Community College | Cambridgeshire  | 425         | 27%  |
| Balcarras School            | Gloucestershire | 1170        | 2%   |

\* Proportion of pupils eligible for free school meals

We gratefully acknowledge the contributions of Essex, Cambridgeshire and Gloucestershire LEAs in helping to produce these materials.

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## Introduction

This course is part of the mathematics strand core training for schools in 2003–04. It builds on the *Interacting with mathematics in Key Stage 3* Year 8 handling data training from 2002–03. Participants should be familiar with the unit plan for handling data in the Year 8 mini-pack and, preferably, have collaborated with colleagues in planning, teaching and reviewing lessons within it.

This handbook contains handouts for six sessions. The course is designed so that all participants will be offered four sessions, including sessions 1 and 2. The Key Stage 3 mathematics team in your LEA will decide which are the most appropriate sessions for their schools.

Following the course, you are recommended to store these notes and the accompanying CD-ROM with the Year 8 handling data mini-pack in the *Interacting with mathematics in Key Stage 3* file.

### Aims, outcomes and structure of the course

The focus of this course is to study progression in handling data in Key Stage 3. By revisiting aspects of the Year 8 handling data mini-pack, you will have the opportunity to consider how you might develop some alternative approaches and how the ideas may be adapted and developed in Years 7 and 9.

If you have not yet had the opportunity to use the Year 8 handling data mini-pack, the course will help you develop some teaching plans to try out with one or more of your classes. If you have already successfully implemented some of the ideas in the Year 8 mini-pack, you will be supported in designing some teaching plans for a Year 7 or a Year 9 class. You will also have a chance to consider how this training might be disseminated to your colleagues back in school.

### Structure of this handbook

The following pages contain **handouts** used in the resources ‘Securing progression in handling data’ sessions.

Throughout the course you will be encouraged to identify **personal action points** – things you will need to do following the course to ensure your learning is reflected in your work in school and that the key messages are shared with colleagues in your department. A series of forms on which to record these action points is provided on pages 5–7.

A list of the **CD-ROM** contents appears on pages 31–34. This identifies the intended use for each for the components.

Copies of the **slides** used by tutors are printed from page 35.

Finally, at the end of this handbook is an **evaluation form** for the course. Please complete this, remove it from the booklet and hand it to your tutor at the end of the course.

## Personal action points from session 1

---

What more do you need to do to make the most of the Year 8 handling data mini-pack for your Year 8 classes?

---

How will you follow up the messages from session 1 in your teaching of handling data in Years 7, 8 and 9?

---

What will you do after the course to disseminate the messages from session 1 to your colleagues in school?

---

Other points:

## Personal action points from session 2

---

How will you follow up the messages from session 2 in your teaching of handling data in Years 7, 8 and 9?

---

What will you do after the course to disseminate the messages from session 2 to your colleagues in school?

---

Other points:

## Personal action points from the planning sessions

---

Arrangements for teaching your planned sequence:

---

How will you share the outcomes of your planning?

---

How will you disseminate the key messages from the training?

---

Other points:

# Handling data objectives from the yearly teaching programmes (excluding probability)

## Specifying a problem, planning and collecting data

| Supplement of examples | Teaching programme: Year 7  | Teaching programme: Year 8   | Teaching programme: Year 9   | Teaching programme: Year 9 objectives for able pupils                                |
|------------------------|---|--|--|--|
| pp. 248–9              | Given a problem that can be addressed by statistical methods, suggest possible answers.   | Discuss a problem that can be addressed by statistical methods and identify related questions to explore.  | Suggest a problem to explore using statistical methods, frame questions and raise conjectures.   |  |
| pp. 250–1              | Decide which data would be relevant to an enquiry and possible sources.   | Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources.   | Discuss how data relate to a problem; identify possible sources, including primary and secondary sources.  | Identify possible sources of bias and plan how to minimise it.                       |
| pp. 252–5              | Plan how to collect and organise small sets of data; design a data collection sheet or questionnaire to use in a simple survey; construct frequency tables for discrete data, grouped where appropriate in equal class intervals. | Plan how to collect the data, including sample size; construct frequency tables with given equal class intervals for sets of continuous data; design and use two-way tables for discrete data. | <b>Design a survey or experiment to capture the necessary data from one or more sources; determine the sample size and degree of accuracy needed; design, trial and if necessary refine data collection sheets;</b> construct tables for large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables. |  |
| pp. 254–5              | Collect small sets of data from surveys and experiments, as planned.  | Collect data using a suitable method, such as observation, controlled experiment, including data logging using ICT, or questionnaire.  | Gather data from specified secondary sources, including printed tables and lists from ICT-based sources.   | Identify what extra information may be required to pursue a further line of enquiry. |

## Processing and representing data, using ICT as appropriate

| Supplement of examples | Teaching programme: Year 7  | Teaching programme: Year 8  | Teaching programme: Year 9   | Teaching programme: Year 9 objectives for able pupils  |
|------------------------|---|---|--|--|
| pp. 256–61             | Calculate statistics for small sets of discrete data: <ul style="list-style-type: none"> <li>find the mode, median and range, and the modal class for grouped data;</li> <li>calculate the mean, including from a simple frequency table, using a calculator for a larger number of items.</li> </ul> | Calculate statistics, including with a calculator; recognise when it is appropriate to use the range, mean, median and mode and, for grouped data, the modal class; calculate a mean using an assumed mean; construct and use stem-and-leaf diagrams.   | Find summary values that represent the raw data, and select the statistics most appropriate to the problem.  | Find the median and quartiles for large data sets; estimate the mean, median and interquartile range of a large set of grouped data. |
| pp. 262–5              | Construct, on paper and using ICT, graphs and diagrams to represent data, including: <ul style="list-style-type: none"> <li>bar-line graphs;</li> <li>frequency diagrams for grouped discrete data;</li> </ul> use ICT to generate pie charts.  | <p><b>Construct, on paper and using ICT:</b></p> <ul style="list-style-type: none"> <li>pie charts for categorical data;</li> <li>bar charts and frequency diagrams for discrete and continuous data;</li> <li>simple line graphs for time series;</li> <li>simple scatter graphs;</li> </ul> <p><b>identify which are most useful in the context of the problem.</b></p> | Select, construct and modify, on paper and using ICT, suitable graphical representation to progress an enquiry, including: <ul style="list-style-type: none"> <li>line graphs for time series;</li> <li>scatter graphs to develop further understanding of correlation;</li> </ul> | identify key features present in the data.   |

## Interpreting and discussing results

| Supplement of examples | Teaching programme: Year 7  | Teaching programme: Year 8   | Teaching programme: Year 9  | Teaching programme: Year 9 objectives for able pupils  |
|------------------------|---|--|---|--|
| pp. 268–71             | Interpret diagrams and graphs (including pie charts), and draw simple conclusions based on the shape of graphs and simple statistics for a single distribution. | Interpret tables, graphs and diagrams for both discrete and continuous data, and draw inferences that relate to the problem being discussed; relate summarised data to the questions being explored. | Interpret graphs and diagrams and draw inferences to support or cast doubt on initial conjectures; have a basic understanding of correlation.                 | Analyse data to find patterns and exceptions; look for cause and effect and try to explain anomalies.  |
| pp. 272–3              | <b>Compare two simple distributions using the range and one of the mode, median or mean.</b>  | Compare two distributions using the range and one or more of the mode, median and mean.  | Compare two or more distributions and make inferences, using the shape of the distributions, the range of data and  | appropriate statistics.  |
| pp. 272–3              |   | Write a short report of a statistical enquiry and illustrate with appropriate diagrams, graphs and charts, using ICT as appropriate; justify the choice of what is presented.                        | Communicate orally and on paper the results of a statistical enquiry and the methods used, using ICT as appropriate; justify the choice of what is presented. | <b>Communicate interpretations and results of a statistical enquiry using selected tables, graphs and diagrams in support,</b> using ICT as appropriate. |

Source: Framework for teaching mathematics: Years 7, 8 and 9, section 3, pages 7, 9, 11 and 13

## Handling data vocabulary checklists

| Year 6  | Year 7  | Year 8       | Year 9   |
|---|---|--------------|--|
| <p>Carroll diagram, Venn diagram<br/>                     classify, outcome<br/>                     count, tally, sort, vote<br/>                     data, database<br/>                     diagram<br/>                     graph, block graph, line graph<br/>                     group, set<br/>                     label, title, axis, axes<br/>                     least popular, least common<br/>                     list, chart, bar chart, bar line chart<br/>                     maximum/minimum value<br/>                     mode, range, mean, average, median<br/>                     most popular, most common<br/>                     pictogram<br/>                     represent<br/>                     statistics, distribution<br/>                     survey, questionnaire<br/>                     table, frequency table<br/>                     tally chart</p> | <p><i>average</i><br/> <i>bar chart</i><br/>                     bar-line graph<br/>                     class interval<br/>                     data collection sheet<br/>                     data, grouped data<br/>                     database<br/>                     experiment<br/>                     frequency<br/>                     frequency chart<br/>                     frequency diagram<br/>                     interpret<br/>                     interval<br/>                     label<br/>                     mean<br/>                     median<br/>                     mode, modal class/group<br/>                     pie chart<br/>                     questionnaire<br/>                     range<br/>                     represent<br/>                     statistic, statistics<br/>                     survey<br/>                     table<br/>                     tally</p> | <p>title</p> | <p>continuous<br/>                     data log<br/>                     discrete<br/>                     distance-time graph<br/>                     distribution<br/>                     interrogate<br/>                     line graph<br/>                     population pyramid<br/>                     primary source<br/>                     sample<br/>                     scatter graph<br/>                     secondary source<br/>                     stem-and-leaf diagram<br/>                     two-way table</p> |

bias  
 census  
 cumulative frequency

## Census at School data from the Year 8 handling data CD-ROM data library

| Column heading |   |
|----------------|---|
| Key Stage      | 2 – Primary 7 to 11 year olds<br>3 – Secondary 11 to 16 year olds   |
| Gender         | M – Male<br>F – Female  |
| DOB            | Date of Birth (dd/mm/yyyy)  |
| Yr Group       | 3 – age 7-8yrs<br>4 – age 8-9yrs<br>5 – age 9-10yrs<br>6 – age 10-11yrs<br>7 – age 11-12yrs<br>8 – age 12-13yrs<br>9 – age 13-14yrs<br>10 – age 14-15yrs<br>11 – age 15-16yrs |
| Place of Birth | 1 – England<br>2 – Wales<br>3 – Scotland<br>4 – Northern Ireland<br>5 – Rep of Ireland<br>6 – Other European<br>7 – Outside Europe  |
| Height         | Height to the nearest centimetre  |
| Foot Length    | Measured to the nearest half centimetre (You may need to widen the column in Excel to see this displayed to one decimal place.)   |
| Football Team  | Favourite football team codes are given in a separate document available on site  |
| Mobile         | 0 – no Mobile Phone<br>1 – pupil has their own personal mobile phone  |
| Computer       | 0 – no access at home<br>1 – pupil has access to a computer at home   |
| Internet       | 0 – no access at home<br>1 – pupil has access to the Internet at home   |
| Cans           | Number of cans drunk in the last 2 days   |
| Bottles        | Number of bottles drunk in the last 2 days  |

|                               |   |                                   |                                  |                             |  |                               |                       |
|-------------------------------|---|-----------------------------------|----------------------------------|-----------------------------|--|-------------------------------|-----------------------|
| <b>Moved</b>                  | <b>0</b> – No   | <b>1</b> – Yes                    |                                  |                             |  |                               |                       |
| <b>Abroad</b>                 | <b>0</b> – No   | <b>1</b> – Yes                    |                                  |                             |  |                               |                       |
| <b>House Type</b>             | <b>1</b> – House/Bungalow (KS2 only)  | <b>2</b> – Detached House (KS3/4) | <b>3</b> – Semi-detached (KS3/4) | <b>4</b> – Terrace (KS3/4)  | <b>5</b> – Flat of any kind (all pupils) | <b>6</b> – Other (all pupils) |                       |
| <b>Household</b>              | Number of people in household   |                                   |                                  |                             |  |                               |                       |
| <b>U18 Male</b>               | Number of U18 males in household  |                                   |                                  |                             |  |                               |                       |
| <b>U18 Female</b>             | Number of U18 females in household  |                                   |                                  |                             |  |                               |                       |
| <b>Cars</b>                   | Number of cars owned by household   |                                   |                                  |                             |  |                               |                       |
| <b>Favourite Subject 1</b>    | <b>1</b> – Art  | <b>2</b> – ICT/ Computing         | <b>3</b> – English               | <b>4</b> – Geography        | <b>5</b> – History                       |                               |                       |
| <b>Subject 2 (KS3/4 only)</b> | <b>6</b> – Mathematics  | <b>7</b> – PE/Sport               | <b>8</b> – Other                 | <b>9</b> – Foreign Language | <b>10</b> – Music                        |                               |                       |
| <b>Subject 3 (KS3/4 only)</b> | <b>11</b> – Science   | <b>12</b> – Design/Technology     | <b>13</b> – R E                  | <b>14</b> – Irish           | <b>15</b> – Welsh                        |                               |                       |
| <b>Travel Type</b>            | <b>1</b> – Walk   | <b>2</b> – Bus                    | <b>3</b> – Car                   | <b>4</b> – Cycle            | <b>5</b> – Train/Tube/Tram/Metro         | <b>6</b> – Other              |                       |
| <b>Time</b>                   | In minutes to travel to school  |                                   |                                  |                             |  |                               |                       |
| <b>Distance</b>               | <b>1</b> – less than 1 km   | <b>2</b> – 1-2 km                 | <b>3</b> – 2-3 km                | <b>4</b> – 3-5 km           | <b>5</b> – 5-10 km                       | <b>6</b> – 10-30 km           | <b>7</b> – over 30 km |
| <b>Pets</b>                   | In all pet categories <b>1</b> means the pupil has that type of pet, <b>0</b> means they do not have that pet <b>NB only KS2 answered this question</b> |                                   |                                  |                             |  |                               |                       |

These materials are reproduced here with kind permission of the *Census at School* project ([www.censusatschool.ntu.ac.uk](http://www.censusatschool.ntu.ac.uk)) which is run by the Royal Statistical Society Centre for Statistical Education at Nottingham Trent University.

## Example of records within the *Census at School* spreadsheet

The Year 8 handling data CD-ROM data library holds approximately 700 rural and 1000 urban records.

| Key Stage | Gender | DOB        | Yr Group | Height | Foot | Fball team | M Phone | Computer | Internet | Cans | Bottles | Moved | From abroad |
|-----------|--------|------------|----------|--------|------|------------|---------|----------|----------|------|---------|-------|-------------|
| 3         | F      | 21/03/1988 | 8        | 161    | 25   | 49         | 1       | 1        | 1        | 4    | 6       | 0     | 0           |
| 3         | F      | 18/03/1988 | 8        | 157    | 23   | 0          | 0       | 1        | 1        | 1    | 2       | 0     | 0           |

| House type | Household | U18 male | U18 Female | Cars | Subject 1 | Subject 2 | Subject 3 | Travel type | Time | Distance | No pets | Bird | Cat |
|------------|-----------|----------|------------|------|-----------|-----------|-----------|-------------|------|----------|---------|------|-----|
| 3          | 5         | 0        | 3          | 2    | 1         | 6         | 9         | 2           | 20   | 2        | 0       | 0    | 0   |
| 3          | 4         | 0        | 2          | 2    | 6         | 9         | 5         | 2           | 5    | 5        | 0       | 0    | 0   |

| Dog | Fish | Gerbil | Guinea pig | Hamster | Rabbit | Reptile | Other |
|-----|------|--------|------------|---------|--------|---------|-------|
| 0   | 0    | 0      | 0          | 0       | 0      | 0       | 0     |
| 0   | 0    | 0      | 0          | 0       | 0      | 0       | 0     |

## Evaluating plans

Year 8 pupils proposed the following four approaches to testing the hypothesis:

*In urban schools boys are more likely to cycle to school than girls*

using the *Census at School* (urban file) data set.

In pairs, discuss the responses you might give to the pupils.

### Plan 1

Select all the records of pupils marked 4 for travel type. Draw a pie chart showing the split between boys and girls.

### Plan 2

Pick out all the boys who cycle to school, all the boys who don't cycle to school, all the girls who cycle to school and all the girls who don't cycle to school. Draw a bar chart showing these four groups.

### Plan 3

Count how many boys cycle to school and count how many girls cycle to school. See which is most.

### Plan 4

Draw a pie chart for all the boys showing how many cycle and how many don't. Then do the same for the girls and look for the biggest angle.

## Wise words (Year 7): prompts

### Grouping

Pupils work in groups of four, divided into two pairs.

### Resources:

Copies of the printed resource sheets are available on the Securing progression in handling data CD-ROM.

For each pair, you will need:

- 'Eight charts' cut up (perhaps laminated);
- 'Drafting statements and questions', inserted into a clear plastic wallet;
- water-based pen.

For each pupil, you will need:

- 'Revising statements and questions' sheet.

### Stage 1: Drafting

Key words: mode, range, total, proportion, percentage, decimal, fraction

Ask each pair of pupils to compose **two** statements to describe a chart, which their partner pair must try to identify. Each statement must use only one key word and must not say whether it is a bar chart or a pie chart.

Say that the two statements about the chart should be written using a water-based pen on the plastic wallet over the table 'Drafting statements and questions'. Emphasise that, as stated on the table:

- one statement should be about **either** proportions (fractions/decimals/percentage) **or** totals;
- one statement should be about **either** the range **or** the mode.

### Stage 2: Questioning and choosing

Ask each pair to pass their 'Drafting' table to their partner pair who must try to work out which chart is being described. The choosing pair can write one yes/no question and, after getting a response to this, they circle yes or no and make a choice of chart.

### Stage 3: Reviewing

Now ask the two pairs to work together to review the process.

- Were their choices correct?
- Which charts were hard to choose between? Why?
- Were their statements accurate?
- Could the questions have been improved? How?

### Stage 4: Revising

- After the discussion, ask each individual pupil to write an accurate version of the statements and, if appropriate, an improved question on their own table, 'Revising statements and questions'.
- Invite pupils to add a comment about important points to note (see the example on 'Revising statements and questions').

## Wise words: focus for audio discussion

On the audio 'Year 7 pupils' you will hear:

*Drafting:*

Glen and Louise discuss and compose statements for chart 2.

*Questioning and choosing:*

Jo and William, their partner pair, question them and decide which chart is being described.

*Reviewing:*

All four reflect on the process.

Consider these points as you listen to the discussion:

- What are the key decisions pupils make as they compose the statements? What thinking is going on behind this dialogue?
- How does the questioning and choosing stage engage pupils in interpreting the charts?
- How would you support these pupils to improve the language they use in describing the charts?

## Questions from Testbase

The questions used in the question bank are previous Key Stage 3 test questions.

Many schools now have access to Testbase software which can provide copies of all previous test items along with copies of their official mark schemes. Testbase software was sent to all schools in the QCA November 2002 mailing. You need to pay for a licence to access it.

The Testbase reference codes for the questions in the question bank are as follows:

|           | <b>question</b> | <b>target level</b> | <b>Testbase code</b> |
|-----------|-----------------|---------------------|----------------------|
| <b>1</b>  | Sunshine        | level 4             | 01 A1 14             |
| <b>2</b>  | Trainers        | level 4             | 95 A1 08             |
| <b>3</b>  | Teachers        | level 5             | 00 A2 17             |
| <b>4</b>  | Survey          | level 5             | 02 A1 19             |
| <b>5</b>  | Ages            | level 5             | 98 A2 12             |
| <b>6</b>  | Swim            | level 6             | 96 B2 15             |
| <b>7</b>  | Mice            | level 6             | 02 B1 17             |
| <b>8</b>  | Libraries       | level 6             | 02 B2 18             |
| <b>9</b>  | Cycling         | level 7             | 95 D2 10             |
| <b>10</b> | Time            | level 7             | 99 C2 14             |

To find out if your school has a licence for the Key Stage 3 mathematics database on Testbase see your head of department, ICT coordinator or assessment coordinator. For further details of the programme and how to subscribe visit [www.testbase.co.uk](http://www.testbase.co.uk).

## Revising explanations (Year 9): prompts

These following tasks use resources available from the Year 9 folder on the Securing progression in handling data CD-ROM. Select from these according to the needs of your class.

- Handling data question bank provides a set of ten questions ranging from level 4 to level 7 drawn from previous Key Stage 3 tests.
- Responses gives examples of pupils' responses to the 'explaining' part of each question.

### Task 1 (whole class): Developing explanations

The teacher leads the class through the process of composing an explanation to a selected question.

#### Preliminary step

In some questions the 'explain' part is presented towards the end. Where this is the case it would be useful to work through the preceding parts, dealing with any misunderstandings, before starting this activity on composing explanations. This might be done in an earlier lesson.

#### Explaining stage

Focus on the 'explain' part of the selected question. Emphasise that pupils should not think of this as a test question. They are to imagine that they are putting the chart and the requested explanation into a magazine article. The explanation should be about three or four sentences long.

The following steps may be ordered differently to suit a particular class.

- 1 Model how to compose a written explanation, explaining your thinking aloud and pointing out key features such as correct use of technical vocabulary or appropriate use of words such as *whereas*, *though*, *while*, *unless*, *however*, *equally* and *also*.<sup>1</sup>
- 2 Ask pupils to work in pairs to compose one written explanation (perhaps on a whiteboard).
- 3 Select a response to the chosen question (either from your class or from the CD-ROM). Show it to the class and together with the pupils, analyse, annotate and perhaps revise the response. (Examples of annotated scripts are available on the CD-ROM to illustrate what this step might look like.)
- 4 Ask pairs to review their own explanation in light of the whole-class discussion.

<sup>1</sup> For more guidance on the use of connectives for contrast or comparison, see *Literacy across the curriculum* module 2, *Literacy in mathematics* (available on the Key Stage 3 website from January 2004).

## **Task 2 (groups): Discussing and revising**

Pupils evaluate each others' explanations.

- Select an appropriate question. Ask pairs of pupils to write their joint explanation on whiteboards, then join with another pair to discuss and evaluate the two responses. Guidance on *The role of the review partner* (CD-ROM) will help here.
- Tell the four to agree a final form of the explanation in the light of their discussion.
- Select one or two examples, discuss the explanations with the class and ask pupils to explain how their discussions improved their writing.

## **Task 3 (whole class): Assessing explanations**

Pupils assess other people's answers in test conditions.

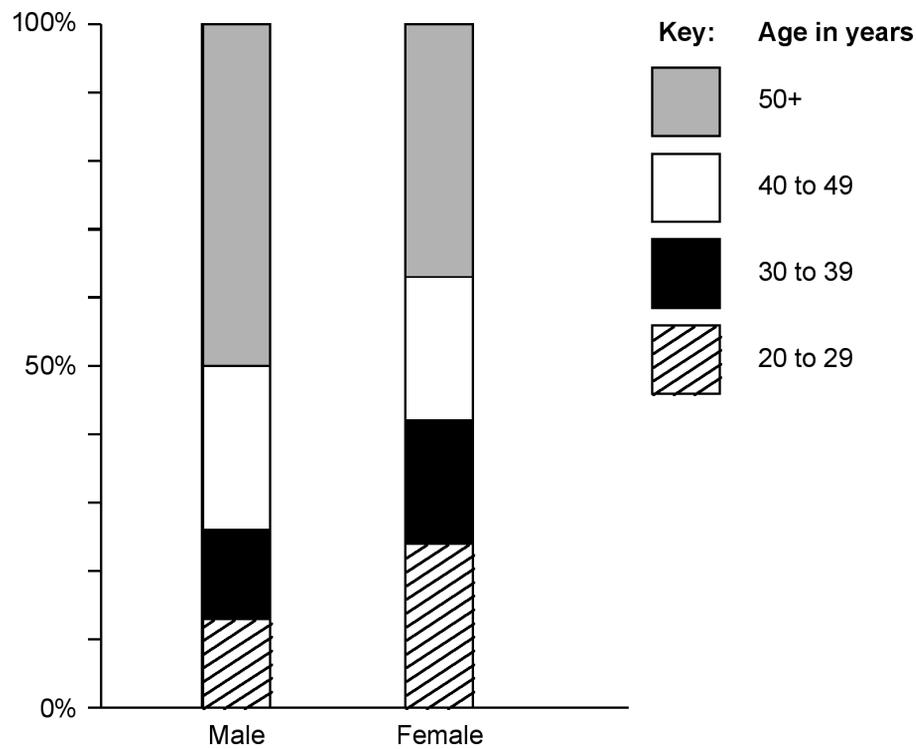
- Select a question and six brief explanations written under test conditions (available on the CD-ROM). Display or distribute these to the class. Explain that three answers would gain full marks and three would not. One of each is already identified.
- Together with the pupils, 'mark' the remaining answers, showing why some are deficient and how they should be improved. Correct and incorrect responses are identified for teacher use on the *Test answer summary sheet* (CD-ROM).

# Key Stage 3 test question (2000 A2 17): Teachers

## 1. Teachers

A newspaper predicts what the ages of secondary school teachers will be in six years' time.

They print this chart.



(a) The chart shows **24%** of male teachers will be aged 40 to 49

About what percentage of female teachers will be aged 40 to 49?

 .....

1 mark

(b) About what percentage of **female** teachers will be aged **50+**?

 .....

1 mark

(c) The newspaper predicts there will be about **20 000** male teachers aged 40 to 49

Estimate the number of male teachers that will be aged 50+

 .....

1 mark

- (d) Assume the total number of male teachers will be about the same as the total number of female teachers.

Use the chart to decide which statement is correct.

Tick (✓) your answer.



Generally, male teachers will tend to be younger than female teachers.

Generally, female teachers will tend to be younger than male teachers.

Explain how you used the chart to decide.



1 mark

Total 4 marks

## Revising explanations: focus for audio discussion

On the audio 'Year 9 pupils' you will hear:

*Discussing and revising:*

- Anthony and Louise compose an explanation to part (d) of the 'Teachers' question.
- Charlene and Keith do the same.

Consider these points as you listen to the discussion:

- As each pair composes their writing, how does each pupil contribute to the development of this explanation from an oral to a written form?
- How does the group of four draw on the separate written explanation to produce an improved version?

## Pupils' responses to the Teachers question

Anthony and Louise

50+ Bar bigger on males than female.

20-29 is bigger on female than male.

so we come to a conclusion that female teachers are younger than male teachers.

Charlene and Keith

60% of women are under 30, while only 50% of men are under 30. Just over 10% of males are between 20 to 29, while there is about 25% of female between 20 to 29.

## Year 8 handling data unit: objectives

- A** Discuss a problem that can be addressed by statistical methods and identify related questions to explore.
- B** Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources.
- C** Plan how to collect the data, including sample size; design and use two-way tables for discrete data.
- E** Calculate statistics, including with a calculator; recognise when it is appropriate to use the range, mean, median and mode; construct and use stem-and-leaf diagrams.
- [E Year 7]** Calculate statistics for small sets of discrete data:
- find the mode, median and range;
  - calculate the mean, including from a simple frequency table, using a calculator for a large number of items.
- F Construct, on paper and using ICT:**
- **pie charts for categorical data;**
  - **bar charts and frequency diagrams for discrete data;**
  - **simple scatter graphs;**
- identify which are most useful in the context of the problem.**
- G** Interpret tables, graphs and diagrams for discrete data, and draw inferences that relate to the problem being discussed; relate summarised data to the questions being explored.
- H** Communicate orally and on paper the results of a statistical enquiry and the methods used, using ICT as appropriate; justify the choice of what is presented.
- I** Solve more complex problems by breaking them into smaller steps or tasks, choosing and using resources, including ICT.

## Year 8 handling data unit: tasks

### Task 1

You have been allocated one of these stages of the handling data cycle: 'specify and plan', 'process and represent' or 'interpret and discuss'.

In pairs, study the unit overview (mini-pack page 7) and unit plan (pages 8 and 9).

Discuss and agree:

- How do the objectives listed on page 5 of the mini-pack (reprinted on handbook 3.1) correspond to your stage? (2 minutes)
- How might you supplement the teaching notes for oral and mental starters, the main teaching and the plenaries in preparation for teaching this part of the unit? (5 minutes)

Be prepared to provide feedback on key thoughts on the second bullet point.

### Task 2

Identify and be prepared to comment on:

- ideas you have gleaned which you would like to incorporate into your teaching and why;
- activities which you feel would stimulate your classes and why.

## Aims of the Year 8 handling data unit

Successful implementation of the Year 8 handling data unit should:

- engage pupils in purposeful enquiry;
- place an emphasis on interpretation and inference;
- encourage group work and discussion between pupils as a means of developing understanding;
- improve pupils' ability to reason and explain their reasoning.

This is a useful checklist when evaluating teaching plans.

## Teaching plan checklist

Plan a teaching sequence (one or more linked lessons) based on part of the Year 8 handling data unit.

Decide:

- the class (or classes) you will use it with;
- the unit in your scheme of work into which it will fit.

Include in your plans:

- teaching time for the lesson(s);
- objectives drawn from the unit;
- appropriate oral and mental starters;
- an outline of the main teaching points, including important lines of questioning;
- the main activities for pupils and how they can be developed, including extensions and simplifications;
- key mathematical vocabulary and notation;
- resources (making reference to ITPs previewed earlier);
- how you will organise and group the pupils;
- ideas to be drawn out in plenary sessions, including some possible key questions.

For more guidance on moving from medium-term to short-term lesson plans, see pages 54–56 in the Guide to the Framework.

## Sharing practice in using the Year 8 handling data mini-pack

Reflect on how you have used the Year 8 handling data mini-pack in your teaching. Some aspects you might consider are:

### How you used the Year 8 mini-pack

- How did you integrate the materials into your planning for Year 8?
- How did you adapt the materials for use with different ability groups?
- Which aspects of the unit were most successful?
- Which aspects were least successful? Why?
- Which of the suggested teaching strategies were most successful?
- Which resources did you find of most use?
- What changes will you make in future years?

### How pupils responded

- How did pupils respond to the materials?
- In which aspects of the handling data cycle did pupils make progress?
- In which aspects did pupils experience difficulties? How were these difficulties overcome?

### How the department was involved

- How were the materials promoted in your department?
- Did you have an opportunity to discuss, as a department, the teaching approaches promoted?
- Did you have an opportunity to discuss pupils' responses to the handling data work?
- How could you improve the way the materials are used in your department?

# Planning to test a hypothesis

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**Hypothesis**

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**Plan 2**

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**Joint plan**

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**Plan 1**



### Objectives for session 1



- To explain the purpose and structure of the training
- To identify and consider progression in handling data from Y7 to Y9
- To explore further the early parts of the handling data cycle: specifying a problem, planning and collecting data

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### Impact of Year 8 handling data unit



- More effective use of group work
- Improved emphasis on the interpretation of data
- Conjecturing from a wider range of data representation
- Better strategies to promote deeper thinking
- More use of 'real' data
- Stimulating departmental discussions

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### Progression in handling data



- What are the main themes for which progression is exemplified?
- What are the main differences from year to year?

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### Implications for planning



- Pupils should be given opportunities to:
- apply skills to increasingly longer pieces of work
  - rehearse a range of skills prior to selecting from them for application in specific pieces of work
  - consider the whole handling data cycle when planning extended work
  - where possible, use real data in engaging contexts

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### Using the Framework supplement of examples



The supplement of examples can help planning by:

- confirming definitions
- illustrating stages of progression
- suggesting useful problems and starting points
- clarifying expectations

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### Two ways of getting started



- Identify a question of concern and relevance and then decide what data is required  
e.g. *Would it be economic to open the school shop after school?*
- Use secondary data (on a topic likely to be of relevance) to raise questions or hypotheses to test  
e.g. *Looking at data on Lottery winnings, are you more likely to win a larger sum on roll-over weeks?*

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### Five hypotheses from pupils



- 1 More people would eat fruit in school dinners if they stopped serving chips.
- 2 It would be economically feasible to build and run a cinema in Kidderminster.
- 3 Girls spend longer doing their homework than boys.
- 4 During the Second World War, children were fitter than they are now.
- 5 People with blue eyes have quicker reaction times than those with brown eyes.

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### Planning a questionnaire: problem questions



Avoid asking questions that:

- are irrelevant
- cannot be answered
- lead to too many possible answers
- may provide data that cannot easily be quantified or processed
- are biased

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**Objectives for session 2**



- To consider strategies for improving pupils' skills in interpreting data and explaining their reasoning
- To exemplify aspects of progression in handling data by introducing possible approaches suitable for Y7 and Y9

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**Estimating measures**

**Slide 2.1**

Animated slide showing the four groups: veterans, sumo wrestlers, children and footballers

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**Comparing groups**

**Slide 2.2**

Animated slide illustrating the exchange of individuals between groups

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**Sketching distributions**

**Slide 2.3**

Animated slide showing grouped frequency charts for the heights of the four groups

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**Recognising distributions** Slide 2.4

Animated slide showing height distributions for combined pairs of groups

**Age of people in Ireland and Greece** Slide 2.5

Animated slide hiding and revealing details of two pie charts

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### Objective for session 3



- To revisit the Y8 mini-pack on handling data and consider effective ways of using the materials

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### Interacting with mathematics in Key Stage 3



The mini-packs are designed to:

- encourage a fresh look at the mathematics itself
- suggest imaginative activities for promoting mathematical talk
- gather useful resources on which teachers can draw
- stimulate new approaches

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### Objectives for session 4



- To design a teaching sequence for the Y8 handling data unit
- To consider effective strategies for disseminating the key messages from the training

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### Implementing the Y8 data handling unit



- Use the unit without adaptation
- Use the unit but adapt the data files to suit your pupils
- Use the structure of the unit but incorporate some effective teaching ideas from your own scheme of work (or from sessions 1 and 2)
- Use the structure of an existing departmental unit but incorporate some ideas from this unit (or from sessions 1 and 2)

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### Designing a sequence of teaching



- Stage 1 Overall shape**  
Key teaching strategies; activities; contexts
- Stage 2 Key lesson**  
Detailed description of one lesson
- Stage 3 Subsequent (or lead-in) teaching**  
Outline of other lessons

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### Objective for session 5



- To share experiences of using the Y8 mini-pack on handling data and consider ways of developing the ideas in Y7 and Y9

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### Reflection on current practice



#### Individually

Reflect on how you personally have used the Year 8 handling data mini-pack in your teaching.

#### In pairs

Share your experiences focusing on one or two key points each.

#### In fours

Compare notes with another pair, identifying one or two key points.

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### Planning to test a hypothesis



- What sort of thinking did the activity provoke at each stage?
- Where might you use it?
  - Which year group?
  - Which unit?
  - Where in a sequence of lessons?
- How might you adapt it for other year groups?

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### Aims of handling data activities



The activities aim to:

- engage pupils in purposeful enquiry
- place an emphasis on interpretation and inference
- encourage group work and discussion between pupils as a means of developing understanding
- improve pupils' ability to reason and explain their reasoning

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### Objectives for session 6



- To design a teaching sequence on handling data
- To consider effective strategies for disseminating the key messages from the training

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### Designing a teaching sequence



- Start with the objectives
- Make the plans real
- Use a format to suit you
- Share the planning if not the plans
- Locate your teaching sequence clearly
- Incorporate at least one new approach

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### Designing a teaching sequence



- Stage 1 Overall shape**  
Objectives, key teaching strategies, activities, contexts
- Stage 2 Key lesson**  
Detailed description of one lesson
- Stage 3 Subsequent (or lead-in) teaching**  
Outline of other lessons

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## Securing progression in handling data

### Evaluation form

What were the most successful aspects of the course?

What changes would you suggest if today's sessions were repeated?

Please add the titles of the third and fourth sessions you have attended and grade each session for its usefulness.

| Session                                      | Grade* (please circle) | Comment |
|--|------------------------|---------|
| 1 Planning and collecting data               | 1 2 3 4                |         |
| 2 Interpreting data and explaining reasoning | 1 2 3 4                |         |
| 3  | 1 2 3 4                |         |
| 4  | 1 2 3 4                |         |
| Overall grade                                | 1 2 3 4                |         |

\*Grades: 1 very useful; 2 useful; 3 limited use; 4 little or no use

School:

Role:

Please complete and return this form to your course tutor at the end of the training.

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