

Data Handling Work Scheme (Pilot 2008-9)

Before starting this Intermediate (Level 2) FSMQ students should be able to:

- calculate with large numbers, fractions, decimals and percentages, including expressing one quantity as a fraction or percentage of another
- round values to the nearest whole number, 10, 100, 1000, 1/10 (0.1), 1/100 (0.01) etc.
- substitute into formulae expressed in words or symbols.

A suggested work scheme showing topic areas and methods to be covered is given below. This recommends a total of 60 guided learning hours that could be timetabled in a variety of ways eg 2 hours per week for 30 weeks, 4 hours per week for 15 weeks, 5 hours per week for 12 weeks. Although the topic areas are listed separately below, it would be beneficial at times to use a variety of skills within a piece of work.

The following techniques should be introduced as soon as possible and used throughout the course:

- using tables to record results
- using a calculator effectively and efficiently and rounding values appropriately
- using spreadsheets to carry out calculations and display results in tables and statistical charts and graphs
- checking calculations using estimates, inverse operations and alternative methods.

Although the topics are listed separately, it would be beneficial to follow a number of statistical investigations through from the initial collection and organisation of data to an analysis of the situation making use of statistical charts and measures. Where possible these investigations should reflect the students' other areas of work and interests.

Topic Area	Content	Nuffield Resource
<p>Define Hypotheses, Collect and Organise Data (5 hours)</p>	<p>Define a hypothesis, and decide what data needs to be collected or measured in order to test it. Differentiate between discrete and continuous data.</p> <p>Select a suitable sample considering in general terms what would be its appropriate characteristics.</p> <p>Design a questionnaire (ensuring that questions are not biased, leading, complex or offensive) and other data collection forms for data from observation and measurement.</p> <p>Transfer data from data collection forms to tables produced by hand and into a spreadsheet. Include use of tally charts and frequency tables and grouping data using equal and unequal intervals.</p>	<p>Sports Questionnaires (starter) Set of 50 responses in questionnaire form and as a spreadsheet. Teacher Notes include short exercises giving practice in statistical techniques.</p>



Topic Area	Content	Nuffield Resource
<p>Statistical Charts (9 hours)</p>	<p>Draw by hand and interpret:</p> <ul style="list-style-type: none"> pictograms bar charts ordered stem and leaf diagrams (including back-to-back diagrams) histograms (with equal and unequal class widths) pie charts (using the area of the pie charts to compare the characteristics of two different populations) line graphs <p>Use a spreadsheet to draw bar charts, pie charts and line graphs. Interpret what the diagrams tell you about the situation. Discuss the use of scales, area (etc) to exaggerate findings.</p>	<p>Solar Eclipse (starter) Lots of data for discussion and suggestions for analysis.</p> <p>Histogram (skills activity) Instructions explaining how to construct an accurate histogram and frequency polygon in Excel</p> <p>Draw line graphs in Excel (starter) Activity that shows students how to draw line graphs in Excel.</p> <p>Draw pie charts in Excel (starter) Activity that shows students how to draw a pie chart in Excel and change its appearance.</p> <p>Pie Charts (starter) Activity that shows students how to draw a pie chart by hand. Also includes practice exercise with real data – can be used as follow up to ‘Draw pie charts in Excel’ activity.</p> <p>Interpreting Curves (skills activity) Discussion sheets and exercise on interpreting and sketching line graphs. Focuses on the shape of graphs.</p> <p>Safety on the Roads (skills activity) Graphs and charts for interpretation.</p>
<p>Statistical Measures (8 hours)</p>	<p>Find the sum, mean, mode, median and range (raw data and grouped data). This includes finding the mean using a formula in words:</p> $\frac{\text{sum of (mid - value of group} \times \text{frequency)}}{\text{number of observations}}$ <p>or symbols :</p> $\frac{\sum x}{n} \text{ or } \frac{\sum (xf)}{n} \text{ where } n = \sum f .$ <p>Use a calculator to find the standard deviation. Use a spreadsheet to sort data and find the sum, mean, median, mode and range. Print out spreadsheet formulae. Choose appropriate measures of location and spread to represent and compare different sets of data.</p>	<p>Datasets (skills activity) Data concerning road accidents, causes of mortality, marriage, divorce and food consumption in an Excel spreadsheet.</p> <p>Election Results (skills activity) Spreadsheet containing the 2001 and 2005 General Election Results. Select data for practice in drawing charts, finding % etc.</p> <p>5 a day (assignment) An investigation to find out to what extent people understand and follow government advice to eat 5 portions of fruit and vegetables per day.</p>



Topic Area	Content	Nuffield Resource
Cumulative Frequency Graphs (4 hours)	Draw cumulative frequency graphs, indicating the range, median, quartiles, inter-quartile range and percentiles. (Could be drawn on a spreadsheet as well as by hand.) Use cumulative frequency graphs to estimate values.	Cumulative frequency graphs in Excel (skills activity) Activity that shows students how to draw a cumulative frequency graph in Excel.
Box and Whisker Diagrams (4 hours)	Draw and interpret box and whisker diagrams. Use box and whisker diagrams to compare two data sets.	Box and Whisker Plots (skills activity) Students can use this Excel spreadsheet to draw up to 4 box and whisker plots. Includes instructions.
Scatter Diagrams (5 hours)	Understand ideas of positive correlation, negative correlation, strength of correlation and no correlation. Draw a line of best fit by eye through the mean point. Use the line of best fit to estimate missing values.	
Probability (5 hours)	Express probabilities as fractions, decimals and percentages. Understand that probabilities lie between 0 and 1 and understand the numerical values associated with events having low, equally likely and high probabilities. Use $P(\text{not } A) = 1 - P(A)$ Estimate probabilities from real data, understanding the idea of, and limitations of, probability as relative frequency for simple situations. Draw probability diagrams to illustrate results. Use probabilities from small data sets to project to larger populations, understanding the limitations resulting from factors such as sample profile, when the data was collected etc.	A Risky Business (skills activity) Data Sheet and probability worksheet involving accidents in the home and at work and leisure.
		Sports Injuries (skills activity) Discuss the use of real data (gives age and gender, also included on spreadsheet.)
		Applying for HE (skills activity) Data Sheets and spreadsheet giving gender, age, ethnic origin and other information about HE applicants. Worksheet and Teacher Notes suggest uses.
		Crime in the Regions (assignment) Assignment in which students compare crime figures for their region with other regions.
Interpret and Compare Data Sets (6 hours)	Use measures of location and spread and probability together with statistical and probability diagrams to come to conclusions about data and compare similar data sets.	Athletics (skills activity) Excel spreadsheet contains large datasets of track and field events.
		Climate (skills activity) Excel spreadsheet containing sunshine, rainfall and temperature data for England and Wales, Northern Ireland and Scotland for each month in every year from 1961 to 2003.
		Football Figures (skills activity) Excel spreadsheet containing 2007-8 data for each premier league club. Teacher Notes suggest uses.
		Heart Rate (assignment) Assignment in which students are told how to measure heart rate and then asked to plan and carry out an investigation.
		Larks and Owls (assignment) Assignment in which students carry out an investigation involving sleep.



Topic Area	Content	Nuffield Resource
Critical Analysis (6 hours)	Critically examine statistical work done by other people. <ul style="list-style-type: none"> • Consider the use of diagrammatic representations of data in order to bias findings (eg by manipulation of axes or use of area to exaggerate findings). • Question if the data used has been selected to strengthen a case (eg a sub-set of data may have been used or certain data discarded). • Consider whether alternative measures and diagrams would have been more or less useful in highlighting findings. • Identify what it is not possible to conclude from the data and consider what extra information or data is needed. 	Global Warming (assignment) Gives a list of websites that have reports or articles about global warming including statistical evidence. Students analyse one of these reports to meet the second portfolio requirement.
Revision (8 hours)	Revise topics and try past papers. Discuss Data Sheet – make up and try questions based on it.	

