

# MPA skills in Statistics

## Key Processes in Statistics

### Introduction

Statistics, the mathematics of making inferences from data, is best taught in a coherent way in the context of real statistical enquiries so that learning arises naturally from the whole handling data cycle (see below). As an enquiry develops you will need to reinforce and develop certain skills and concepts by direct teaching of particular objectives. It is easier to make sure that problems are relevant if at least some of the enquiries are linked to other subjects. ICT is important for representation and analysis of data. It also enables simulation of events and the processing of large data sets, which helps pupils to understand the relationship between experimental and theoretical probability. The handling data cycle remains valid and is closely linked to the key processes:

- specifying the problem and planning (representing)
- collecting data (representing and analysing)
- processing and representing the data (representing and analysing)
- interpreting and discussing the results (interpreting and communicating).

### Representing

In a statistical enquiry, representing is part of almost all elements of the handling data cycle. It involves:

- suggesting a problem to consider using statistical methods, framing questions and raising conjectures
- deciding what data are relevant and identifying primary or secondary sources
- designing ways of capturing the required data, including minimising sources of bias
- creating representations of the data, including the use of ICT, for example, tabulation, grouping, arrays, diagrams and graphs.

If pupils can represent data as part of a statistical enquiry then they are better positioned to become responsible citizens who can select and sift information thoughtfully and use mathematics with confidence to inform decision-making. Help pupils to see that representation is a major focus of statistics and that it is important to tie together the decisions they make at the different stages of the handling data cycle.

### Analysing &ndash; using mathematical reasoning

Mathematical reasoning is required at all stages of the handling data cycle:

- when specifying and planning by working logically, identifying constraints and considering available techniques; also by exploring conjectures and using knowledge of related problems
- when collecting data by working systematically, exploring the effects of varying values in situations where there is random or systematic variation
- when processing and representing data, making connections within mathematics and identifying patterns and relationships, and making use of feedback from different audiences
- when interpreting and discussing results, explaining and justifying inferences drawn from the data, recognising the limitations of any constraints or assumptions made; using feedback to re-assess initial conjectures and adjust aspects of the handling data cycle.

### Analysing &ndash; using appropriate mathematical procedures

Using appropriate procedures involves manipulating data into suitable forms for accurate representation, calculation and communication. This will involve monitoring the accuracy of methods and solutions. Appropriate procedures in a statistical enquiry are:

- using systematic methods for collecting data from primary and secondary sources
- constructing tables, graphs and diagrams to present data in an organised form
- calculating summary statistics, for example, measures of average and spread
- calculating experimental and theoretical probabilities.

### Interpreting and evaluating

Interpreting and evaluating results is fundamental to any statistical enquiry. It includes:

- interpreting tables, graphs and diagrams, and drawing inferences to support or cast doubt on initial conjectures
- interpreting probabilities when assessing the likelihood of a particular outcome
- comparing distributions and making inferences
- looking at data to find patterns and exceptions
- considering the effects of changes to the data (e.g. removing outliers, adding items, making proportional changes)
- appreciating why the interpretations placed on data have a degree of uncertainty and can be misleading
- appreciating convincing arguments, but knowing that these do not constitute proof.

### Communicating and reflecting

Effective communication and reflection is of particular relevance in statistics. It includes:

- preparing a brief report of a statistical enquiry, using tables, graphs and diagrams to summarise data and support interpretations and inferences drawn from the data
- using precise language to summarise key features pertinent to the conjectures raised
- presenting support for conclusions in a range of convincing forms
- presenting a balanced conclusion where results

are not convincing&bull; considering alternative approaches if results do not provide sufficient evidence.