Data Handling Progression in Maths

May 2014

Purpose of Policy

Data handling is a significant part of the Mathematics Primary Curriculum. This policy will form the basis upon which we map out the learning for Data handling in Mathematics. It will outline progression of across the stages of development, and will inform all teachers of expectations.

Our policy recognises Mathematics as a functional tool and a valuable key life skill. We want all students leaving St Hugh's School to not only be numerate, but to be able to transfer their mathematical skills to other curricular areas and into everyday life. We want to impart to our students that Mathematics is not confined to just acquiring mathematical skills, but most importantly it is about fostering inquiring minds, inciting enthusiasm and valuing curiosity.

The policy reflects the views of all the staff of the school. It has been drawn up following consultation with all staff and students, and has full agreement of the Governing Body.

Staff have access to the Policy via the *Staff Room,* and on the school's server via the *Teacher's Drive*. Parents are also able to access a copy of the policy upon request.
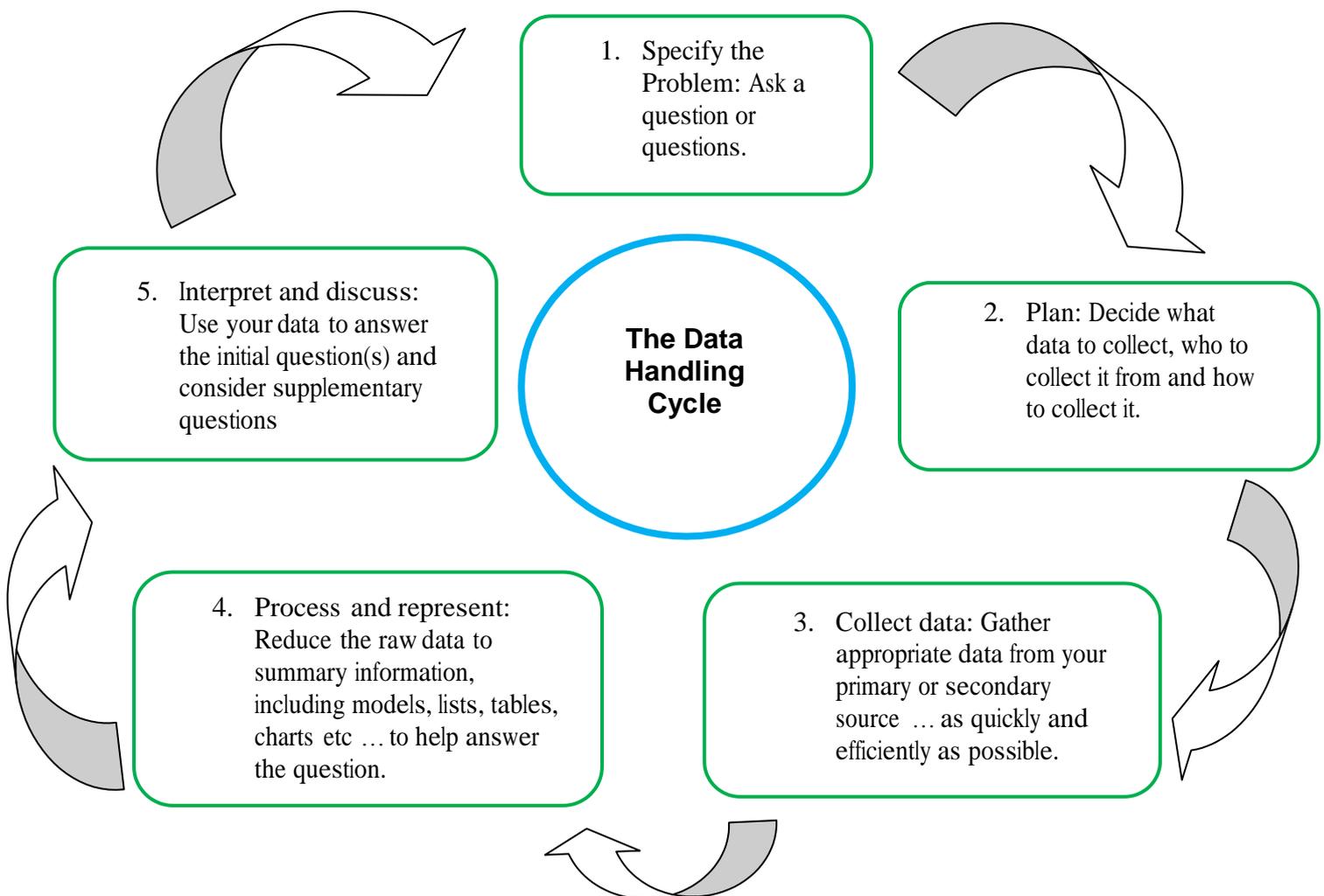
Aims and Outcomes

- To present Data Handling in meaningful contexts.
- To ensure that common errors and misconceptions in Data Handling are addressed.
- To provide staff with an outline of expectations in Data Handling.
- To provide parents with an outline of expectations in Data Handling.
- To ensure continuity and progression in the children's learning of Data Handling, in relation to the following areas:

    (i)   Mathematical Vocabulary
    (ii)   Tally Charts
    (iii)   Venn Diagrams
    (iv)   Carroll Diagrams
    (v)   Pictograms
    (vi)   Bar Charts and Bar Line Graphs
    (vii)   Line Graphs
    (viii)   Pie Charts

Data handling is more than just collecting data. It is important that staff and pupils are aware of, and experience, the data handling cycle in its entirety.

1. Specify the Problem: Ask a question or questions.

The Data Handling Cycle

2. Plan: Decide what data to collect, who to collect it from and how to collect it.

3. Collect data: Gather appropriate data from your primary or secondary source … as quickly and efficiently as possible.

4. Process and represent: Reduce the raw data to summary information, including models, lists, tables, charts etc … to help answer the question.

5. Interpret and discuss: Use your data to answer the initial question(s) and consider supplementary questions

Progression in Data Handling (various sources)

In order for students to gain sound knowledge and understanding of Data Handling in general, we must adhere to the following principles, in order to avoid creating general misconceptions:

a)	Pupils have a balance of experience across the whole cycle of Data Handling. **Weighting** must be given to interpretation and discussion.
b)	Links are always made to real life contexts to give the learning meaning. However avoid common contexts of favourite food, pets, eye colour, modes of transport.
c)	Teachers use all opportunities to model efficient methods of 'best fit' when representing data.
d)	Students experience a balance of various forms of representing data.
e)	Pupils have the opportunity to carry out investigations involving data handling.
f)	Pupils have the opportunity to use ICT to support their understanding of data handling.
g)	Students progress through the steps outlined, and do not repeat the same learning.
h)	Students are given opportunities to select and compare different ways of representing.
i)	Pupils have opportunities to generate as well as answer questions about existing data.
j)	Pupils have opportunities to generate lines of enquiry and decide which data to collect, and how best to represent it with a key development of using ICT to enhance their skills for life.
k)	Students are encouraged to annotate diagrams to assist in their interpretations.
l)	Pupils have the opportunities to make predictions of future patterns and results.
m)	Pupils make links between data handling and probability.

(i) Mathematical Vocabulary

Pupils need to acquire appropriate vocabulary so that they can participate in the activities and lessons that are part of classroom life. There is, however, an even more important reason: mathematical language is crucial to pupil's development of thinking. If pupils don't have the vocabulary to talk about data handling, they cannot make progress in understanding these areas of mathematical knowledge.

Teachers need to plan the introduction of new words in a suitable context, for example, with relevant objects, apparatus, pictures or diagrams. Explain their meanings carefully and rehearse them several times. Encourage their use in context, particularly through questioning. Use every opportunity to draw attention to the new words in whole class, group and individual contexts. The final stages are learning to read and write new mathematical vocabulary in a range of circumstances, ultimately spelling the relevant words correctly.

The following table outlines the progression of mathematical vocabulary in relation to data handling and probability.

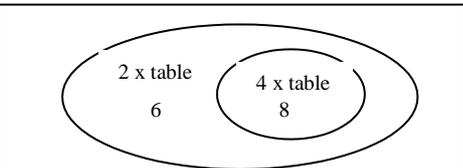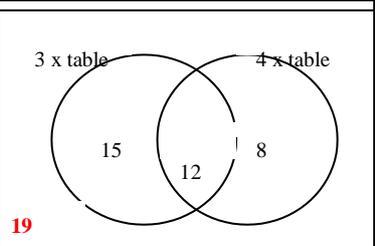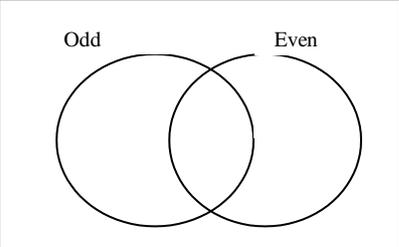|	Step 1	Step 2	Step 3	Step 4
Data Handling	count, sort, vote group, set list same, different table	**Step 1 words, plus:** tally, graph, block graph, pictogram represent label, title most popular, most common least popular, least common, chart, bar chart, frequency table Carroll diagram, Venn diagram, axis, axes diagram	**Step 1& 2 words, plus:** survey, questionnaire, data, tally chart, database, line graph, bar line chart, mode, range maximum/minimum value, outcome	**Step 1, 2 & 3 words, plus:** mean, average, median statistics, distribution, discrete, continuous, positive correlation, negative correlation, no correlation
Probability		**Step 1 words, plus:** fair, unfair likely, unlikely	**Step 1& 2 words, plus:** likelihood certain, uncertain probable, possible, impossible chance, good chance poor chance, no chance risk, doubt	**Step 1, 2 & 3 words, plus:** equally likely equal chance, even chance, fifty-fifty chance biased, random

(ii) Tally and Frequency Charts

In order for pupils to gain sound knowledge and understanding of tally and frequency charts, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Children experience reading from as well as creating tally charts.	E.g. <table><tr><th>Number of goals</th><th>Tally</th></tr><tr><td>0</td><td>III</td></tr><tr><td>1</td><td>III</td></tr><tr><td>2</td><td>II</td></tr><tr><td>3</td><td>IIII</td></tr><tr><td>4</td><td>II</td></tr></table> How many teams scored 3 or more goals?
b) Pupils understand the value of grouping in 5s, and use this to count the total frequency.	E.g. pupils count in groups of 5, rather than individual tallies.
c) Pupils understand the difference between a tally chart and frequency chart.	E.g. **Number of seeds germinated** <table><tr><th>Pot number</th><th>Number of seeds in the pot</th></tr><tr><td>Pot 1</td><td>IIII II</td></tr><tr><td>Pot 2</td><td>III</td></tr><tr><td>Pot 3</td><td>IIII IIII</td></tr><tr><td>Pot 4</td><td>IIII IIII</td></tr></table>

(iii) Venn Diagrams

In order for students to gain sound knowledge and understanding of Venn diagrams, we must adhere to the following principles, in order to avoid creating general misconceptions:

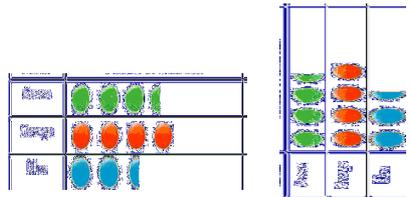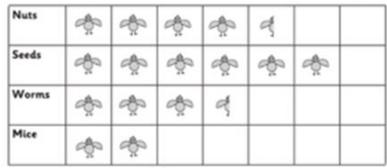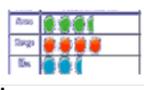| a) Students experience irregular, as well as regular Venn diagrams.	E.g. 2 x table 6, 4 x table 8
b) Students experience and know that not all data necessarily sits inside the circles.	E.g. 3 x table, 4 x table, 15, 12, 8, **19**
c) Students experience deciding on the criteria to use themselves.	E.g. deciding how to sort a selection of 3D shapes.
d) Pupils experience that there will be times when it is not possible for data to sit in the centre.	E.g. Odd, Even
e) Students experience using Venn diagrams with 3 criteria.	Eg.
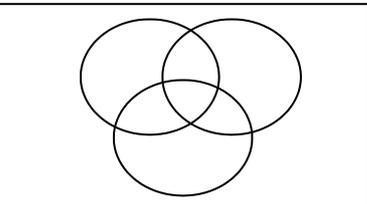
(iv) Carroll diagrams

In order for pupils to gain sound knowledge and understanding of Carroll diagrams, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils experience deciding on the criteria to use themselves.	E.g. students decide how they could sort a selection of clothes.
b) Pupils understand that Carroll diagrams work on the basis of 'fits the criteria, does not fit the criteria'.	E.g. blue, not blue Multiple of 4, not multiple of 4
c) Pupils understand that **all** data should sit inside the table.	E.g. You could not have 'multiple of 3, multiple of 4', as there would be nowhere for multiples of both or neither to sit.
d) Students experience adding their own plausible labels to existing diagrams.	E.g. What could the criteria be?

	?	?
?	Circle Semi-circle	Square Triangle
?	Cone Cylinder	Cube Pyramid

(v) Pictograms

In order for pupils to gain sound knowledge and understanding of pictograms, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Students experience horizontal and vertical pictograms.	E.g.
b) Students experience constructing and reading pictograms with whole and part pictures.	E.g.
c) Children experience a range of different keys with a variety of quantities represented by one picture.	E.g. See example above.
d) Children make links to fractions so they are able to make sense of part pictures.	I know that 5 is ½ of 10, so 1 ½ birds represent the value of 15.
e) Children should have opportunities to suggest their own labels and titles for pictograms.	 . What could this pictogram show?

(vi) Bar Charts and Bar Line Graphs

In order for students to gain sound knowledge and understanding of bar charts, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils understand when to label the line, and when to label the space.	E.g. Lines Spaces
b) Students experience vertical and horizontal bar charts.	E.g.
c) Pupils experience a variety of scales and make informed decisions about selecting appropriate scales to use.	E.g. increasing in steps of 5 for data up to 30, 10/25 for data up to 100 but steps of 200 for data up to 1000.
d) Pupils experience bars that are in between the marked scales.	E.g.
e) Students experience labelling their own axes.	E.g. what could the above bar chart show?

(vii) Line Graphs

In order for pupils to gain sound knowledge and understanding of line graphs, we must adhere to the following principles, in order to avoid creating general misconceptions:
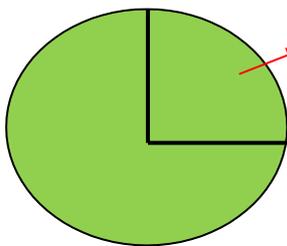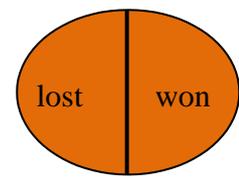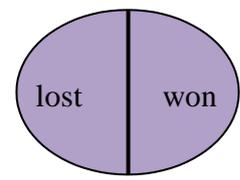
a) Pupils understand that line graphs represent continuous data rather than discrete data.	E.g. temperature, time, mass, capacity, age etc.

b)	Pupils recognise the link between line graphs and co-ordinate grids.	E.g. the horizontal and vertical axes work in the same way.
c)	Pupils experience a variety of scales and make informed decisions on appropriate scales to use.	E.g. increase in steps other than 1, 2, 5 and 10. Use steps of decimal numbers.
d)	Students link line graphs to a 'story' or narrative over time.	E.g. The line is going up gradually as the bath is being run, the part that is horizontal is where the person is in the bath. She then let out a little bit of water and added some more hot, which is why the graph dips slightly then goes back up. She then lets all the water out which is where the graph gradually decreases to 0.
e)	Students experience that line graphs are not always over time (e.g. conversion graphs).	E.g. Dollars to pounds
f)	Pupils experience labelling their own axes.	E.g. what could the story of this graph be? Add the labels.
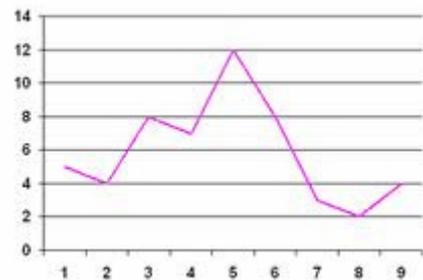
(viii)   Pie Charts

In order for students to gain sound knowledge and understanding of pie charts, we must adhere to the following principles, in order to avoid creating general misconceptions:
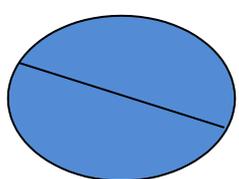
a)	Students make the links between pie charts and fractions, decimals, percentages and angles.	E.g. ¼ , 0.25, 25%, 90°
b)	Pupils experience comparing pie charts with different overall totals.	E.g. 6 games 8 games Which team won the most games? How do you know?
c)	Pupils experience pie charts which are not aligned to the 12 o'clock position.	E.g.

Progression in Data Handling

Although the range of representations should be used in every year group, there should be clear progression in the teaching and learning of each. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Tally and frequency charts	Use pre-made tables. Complete using 5 tally gates. Read off of existing charts.	Creating own tables and introducing frequency tables. Read off of existing tables.	Selecting when to when it is appropriate to use tally and frequency charts.	Use and apply tally and frequency charts independently.		
Venn Diagrams	Use pre-made diagrams. Sort using one criterion, moving to two separate criteria. Read off of existing diagrams.	Use pre-made diagrams. Sort using two overlapping criteria. Read off of existing diagrams.	Create own diagrams. Sort using three overlapping criteria. Read off of existing diagrams.	Select when it is appropriate to use a Venn diagram. Use and apply Venn diagrams independently.		
Carroll Diagrams	Use pre-made diagrams. Use one 'fits the criteria, does not fit the criteria'. Read off of existing diagrams.	Use pre-made diagrams. Use two 'fits the criteria, does not fit the criteria' Read off of existing diagrams.	Create own diagrams. Decide on own criteria.	Select when it is appropriate to use a Carroll diagram. Use and apply Carroll diagrams independently.		
Pictograms	Interpret data from pictograms.	Construct pictograms using one picture for one item.	Construct pictograms using one picture to represent multiple items. Introduce standardised symbols.	Select when it is appropriate to use a pictogram. Use and apply pictograms independently.		
Bar/ bar line graphs	Interpret data from simple bar charts.	Construct bars on to pre made axes. Scale increases in steps of one.	Construct own bar charts, Scales increase in steps other than one.	Introduce bar line graphs.	Introduce bar charts representing grouped data.	Manipulate data by adjusting scales. Construct one graph to show more than one set of data.
Line graphs			Interpret data from line graphs.	Interpret data that lies between divisions. Construct line graphs.	Experience scales that do not start at zero. Construct line graphs representing more than one set of data.	Link line graphs to scatter graphs. Discuss positive and negative correlations.
Pie charts			Interpret data	Interpret data	Compare pie	Construct pie

		from simple pie charts involving halves, quarters and thirds.	from pie charts involving more complex proportions.	charts with different values for the whole.	charts.

Review

This policy is monitored through:

• Regular scrutiny of children's books
• Regular monitoring of teaching plans
• Evaluation and review of assessment data
• Lesson observations to monitor the quality of teaching and implementation of teaching plans
• Pupil interviews

This policy is reviewed by staff and governors every two years. The next review is due May 2015. Parents are most welcome to request copies of this document and comments are invited from anyone involved in the life of the school.