Overview: *All in a Jumble*

Problem outline

This problem gives a set of 'jumbled up' measurements that need to be sorted. The interactivity changes each time you use it, so it is possible to use the same problem several times with a group. Cards are also available to support group work away from the computer. For some items there are a few numbers which could be valid and the aim is to juggle them to find a combination where every measurement makes sense.

Why do this problem?

This problem gives opportunities for pupils to focus on effective ways of working with data that needs ordering. The relatively closed nature of the problem provides a secure context in which pupils can work together and put forward the cases for their views. The openness comes from the routes to a solution, not the solution itself. Time can also be spent helping pupils reflect on ways of working together by asking about which collaboration had the most positive impact on their thinking.

For the problem itself and some associated teachers' notes

All in a Jumble

Curriculum references: process

The guidance sections 'What teachers might do' offer suggested actions that can help to draw out pupils' skills in how to use mathematical reasoning. There is, however, a breadth of opportunities to develop a range of process skills including:

- Make and justify conjectures, considering special cases and counter-examples.
- Work systematically and logically towards results and solutions.
- Use estimation and approximation to support decisions and check reasonableness of answers.
- Form convincing arguments.
- Engage in mathematical discussion of the appropriateness and accuracy of data matches, making connections with the context.

Curriculum references: content

Geometry and measures: Measures and mensuration

Select and use appropriate units, estimating and using the equivalence of units.

Other useful links

Article: A Brief History of Time Measurement

How the problem might unfold: *All in a Jumble*

What teachers might do

To give a context to the task and alert pupils to their prior knowledge, bring examples of everyday objects, whose measurements are known/given, into the classroom to stimulate initial discussion.

Use recent events (a world record in athletics, for example) to encourage pupils to talk about measurements they know.

Give pupils time to become familiar with the information that is being presented, to look at and discuss the cards and the problem. Use the interactivity for sharing ideas with the whole group.

Try to keep pupils working collaboratively in small groups throughout most of the lesson, so that there is plenty of time for them to discuss, disagree and agree.

After a short time, ask pupils to identify the types of criteria they are using to make decisions about which cards to put together. Ask:

- What things are helping you make your decisions?
- Were some cards easy to put together to start with? Why?
- How many different cards involve length, mass …?

As they work, encourage pupils to listen to each other's arguments. Challenge them to make cases for their choices. Ask:

- P says that this must be litres … what do you think Q?
- Why can't this be …?
- How do you know this card does not belong with …?

Use questioning to raise awareness of estimations. For example, ask:

- What is your mass and how much more do you think the mass of an adult is?
- How much water is in that bottle, and how many bottles do you think you would need to fill a bath?

Discuss, with the whole class, the different strategies that groups used for making choices. For example, highlight things that 'had to be …' and things that 'couldn't be …'

Talk about successful communication techniques adopted by the groups.

Discuss the use of approximation in the software itself.

What learners might do

- Pupils classify the cards and adopt systematic approaches. For example, they group measurements related to distance and cards with units that represent distances.
- Groups identify criteria they will use to help them make decisions.
- They identify impossibilities or range of possibilities and use estimations and their knowledge of units.
- Pupils discuss the properties of, and possibilities for, different combinations, compare ideas and argue their cases for particular combinations.
- They listen to the arguments presented by others and use 'if–then' statements to justify their ideas and make a joint, reasoned, decision.
- Share views about how effectively they worked together.

How the problem might be focused: *All in a Jumble*

Focus	What learners might do	What teachers might do
Representing		
Analysing – use mathematical reasoning	• Classify the cards and adopt systematic approaches. For example, group together measurements related to distance and cards with units that represent distances. • Discuss the properties of and possibilities for different combinations. • Suggest alternatives. • Argue a case for particular combinations. • Listen to the arguments presented by others. • Identify impossibilities or range of possibilities.	Give pupils time to become familiar with the information that is being presented, to look at and discuss the cards and the problem. Use the interactivity for sharing ideas with the whole group. Try to keep pupils working collaboratively in small groups so that there is plenty of time for them to discuss, disagree and agree. Encourage pupils to listen to one another's arguments. Challenge them to make cases for their choices. Ask: • P says that this must be litres … what do you think Q? • Why can't this be …? • How do you know this card does not belong with …?
Analysing – use appropriate mathematical procedures	• Use estimations to identify possibilities. • Narrow down possibilities, for example, by using knowledge of units.	Use questioning to raise awareness of estimations. For example, ask: • What is your mass and how much more do you think the mass of an adult is? • How much water is in that bottle, and how many bottles do you think you would need to fill a bath? To stimulate initial discussion, bring into the classroom some everyday objects which give their measurements. Use recent events (a world record in athletics, for example) to encourage pupils to talk about measurements they know.
Interpreting and evaluating	• Share ideas within groups. • Identify criteria they will use to make decisions. • Use 'if–then' statements to justify their ideas. • Engage with other pupils' reasoning and compare ideas in order to make a joint reasoned decision. • Consider the appropriateness of possible matches.	Once groups have started to work, ask them to identify the types of criteria they are using to make decisions about which cards to put together. Ask: • What things are helping you make your decisions? • Were some cards easy to put together to start with? Why? • How many different cards involve length, mass …?
Communicating and reflecting	• Listen to one another's ideas. • Discuss ideas and come to a shared set of findings.	Discuss, with the whole class, the different strategies for making choices that groups used. For example, highlight things that 'had to be …' and things that 'couldn't be ...'. Discuss the use of approximation in the software itself. Talk about successful communication techniques used by the groups.