BOWLAND
MATHS
Assessing the Case Studies

You Reckon
Assessing the learning

Case Study description

This case study contains a range of tasks. Assessment guidance is given for three of them, although the same approach can be used for the other tasks.

Suitability National Curriculum levels 4 to 8

Time Each activity is independent and the amount of time required for each will vary according to the amount of research pupils undertake; a rough guide is 1 to 2 lessons.

Resources As for the case study; pupils would also benefit from access to the internet – although this 'research' aspect could be undertaken as homework.

Opportunities to assess Key Processes

- **Representing**: during activities 1, 2 and 3
- **Analysing**: during activities 1, 2 and 3
- **Interpreting and evaluating:** during activities 1, 2 and 3
- **Communicating and reflecting**: during activities 1, 2 and 3.

In addition to assessment of the Key Processes, there are opportunities to assess Range and Content (detail is within the case study) and some of the other personal, learning and thinking skills, particularly for 'team working'.

Activity 1: Stop Thief!

Pupils review an insurance claim.

Teacher guidance

This activity is most suitable for pupils working at NC levels 4 to 6.

Observe how well pupils:

- Decide the information they need and how to use it
- Work towards a solution, and then interpret it
- Present their evidence and conclusion

Video: Stop! Thief!

Questions to ask:

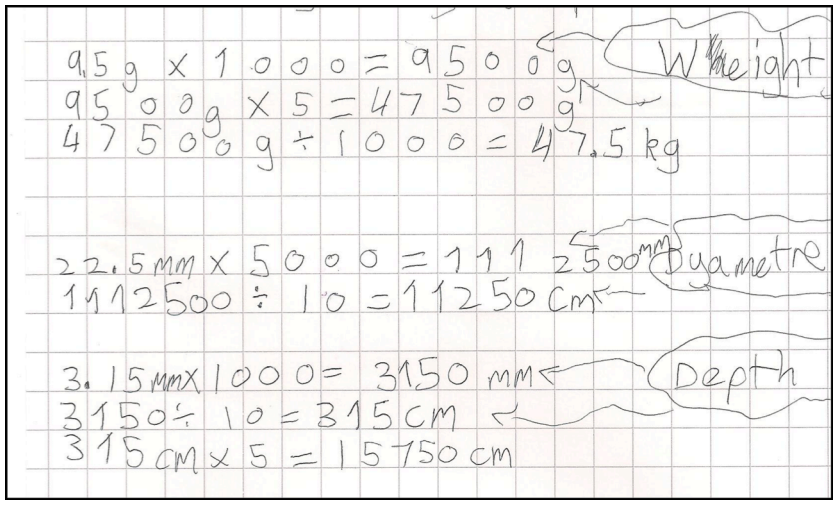
- *What do you need to know to solve the problem? How can you find this information?*
- *Do your answers seem realistic? How accurate do they need to be?*
- *Are there any alternative approaches you could have used?*

Assessment guidance: Progression in Key Processes

	Representing	Analysing	Interpreting and evaluating	Communicating and reflecting
PROGRESSION	Identifies a relevant question, eg 'How heavy is a £1 coin?' Pupil A	Takes a relevant step towards the solution, eg finds the mass (or volume) of a £1 coin	Recognises the need to decide whether the mass (or volume) is realistic	Presents a report (oral or written), but key information is omitted Pupil A
	Identifies relevant questions and recognises how to combine answers	Takes relevant steps, eg finds the mass (or volume) of 5000 £1 coins Pupil A	Uses knowledge of real life to determine whether the mass (or volume) is realistic	Presents a clear report (oral or written) that covers most issues Pupil B
	Identifies information needed and has a clear method for solution Pupil B	Implements a clear and correct method effectively Pupil B	Uses information to reach an informed conclusion Pupil B	Presents a clear and comprehensive report (oral or written)
	Selects only the information needed and has a clear and concise method for solution	Implements a clear, correct and concise method effectively	Reaches an informed conclusion and realises that further work is not necessary	As above and shows evidence of reflection, eg that numbers used are estimates

Sample response: Pupil A

Comments



Pupil A works out the mass, diameter and depth (height) of 5000 £1 coins, but is then uncertain how to proceed.

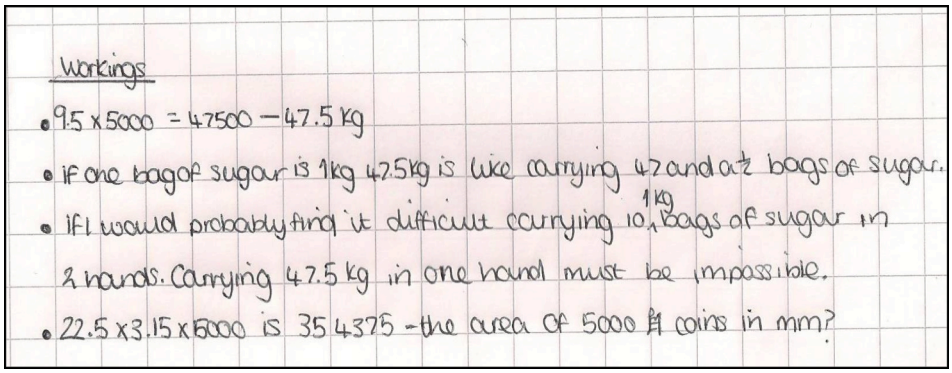
Probing questions and feedback

- *Show me the diameter of a £1 coin. How would the coins be arranged to show 5000 of these diameters? Is that how the coins are arranged in bag of money that is being carried?*
- *What about depth? How would the 5000 coins be arranged? Does that help? Why not?*
- *What does 47.5kg 'feel' like? Does that help? How?*

Pupil A would benefit from working on a range of problems that include redundant information.

Sample response: Pupil B

Comments



Pupil B showed and interpreted relevant calculations, but then continued unnecessarily.

Probing questions and feedback

- *Are all things that weigh 10kg the same shape and size? What else can you think of that weighs 10kg, and could you carry it in one hand?*
- *To find the area of a coin, you did diameter (22.5cm) × depth (3.15mm). Why? What does that give the area of?*

Pupil B would benefit from working on other problems in which she must decide whether or not a solution has been reached. She also needs to develop her understanding of area of a range of shapes, including circles.

Activity 2: Mellow Yellow

This activity focuses on saving water.

Teacher guidance

This activity is most suitable for pupils working at NC levels 5 to 7.

Observe how well pupils:

- Decide the information they need and how to use it
- Work towards a solution, and then interpret it
- Present their evidence and conclusion

A useful source is www.waterwise.org.uk

Questions to ask:

- *What do you need to know to solve the problem? How can you find it?*
- *Do your answers seem realistic? How accurate do they need to be?*
- *Are there any alternative approaches you could have used?*

Assessment guidance: Progression in Key Processes

	Representing	Analysing	Interpreting and evaluating	Communicating and reflecting
PROGRESSION	Identifies a relevant question, eg 'How many flushes per day per person?'	Takes a relevant step towards the solution, eg no. of flushes multiplied by no. of people	Reaches partial conclusions	Presents a clear report (oral or written) that covers most issues
	Identifies relevant questions and recognises how to combine answers	Combines data to take more than one relevant step towards the solution	Reaches an informed conclusion Pupil C	Presents a clear and comprehensive report (oral or written) Pupil C
	Identifies information needed and has a clear method for solution Pupil C	Implements a clear and correct method effectively Pupil C	Reaches an informed conclusion, using appropriate accuracy	As above and shows evidence of reflection, eg that nos. used are estimates
	Selects only the information needed and has a clear and concise method for solution	Implements a clear, correct and concise method effectively	As above and processes findings to make them accessible, eg uses percentages	As above and reflects on the limitations surrounding the findings

Sample response: Pupil C

Comments

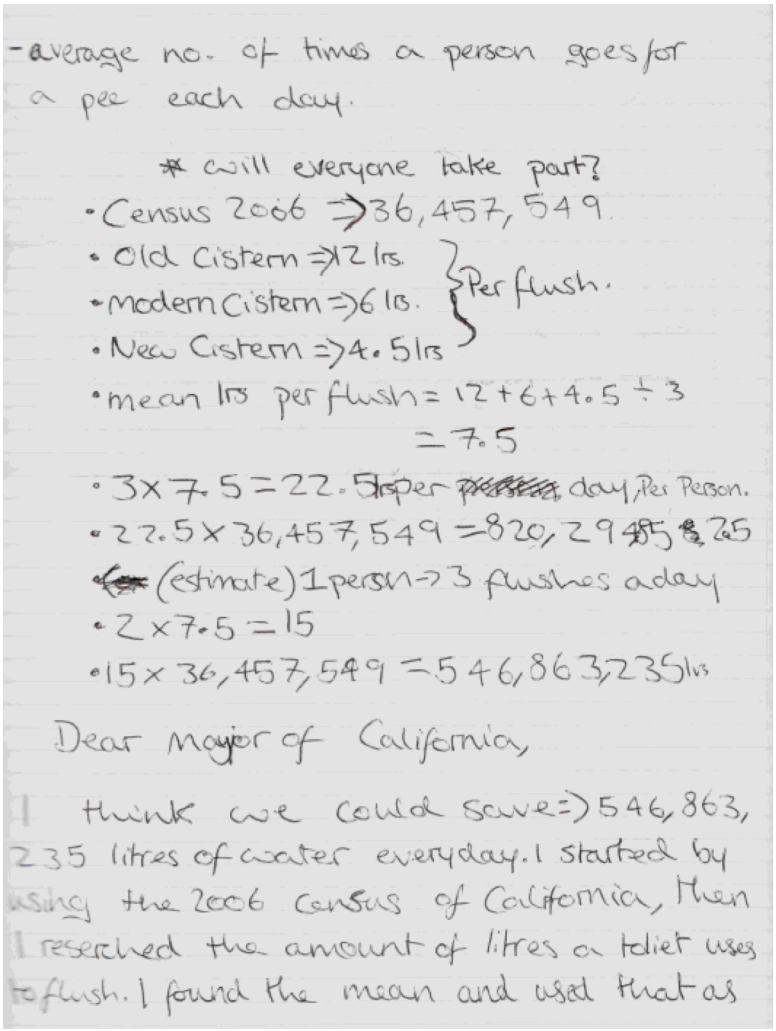
Pupil C formulates her own questions and researches the information needed.

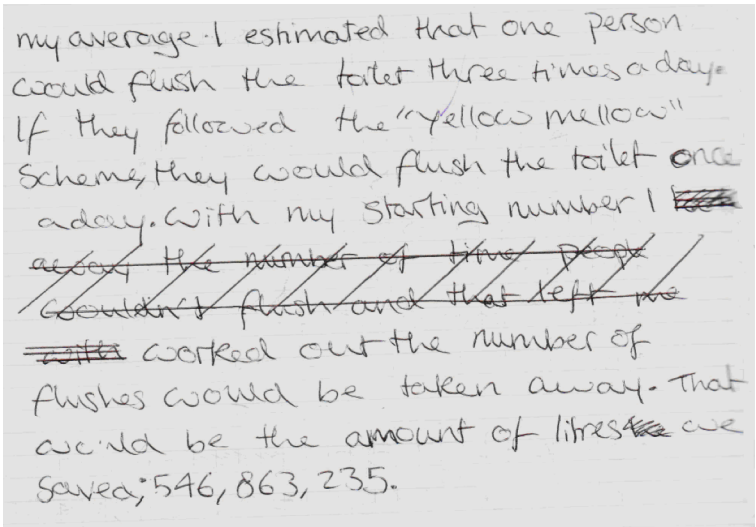
Probing questions and feedback

- *When you found the mean number of litres per flush, what assumptions did you make about the numbers of different types of cisterns people use?*
- *What accuracy would have been more appropriate and why?*
- *Can you think of a way of helping the reader by explaining what 546 million litres of water 'looks' like?*

Pupil C would benefit from discussions about what accuracy is appropriate when solving problems, and why.

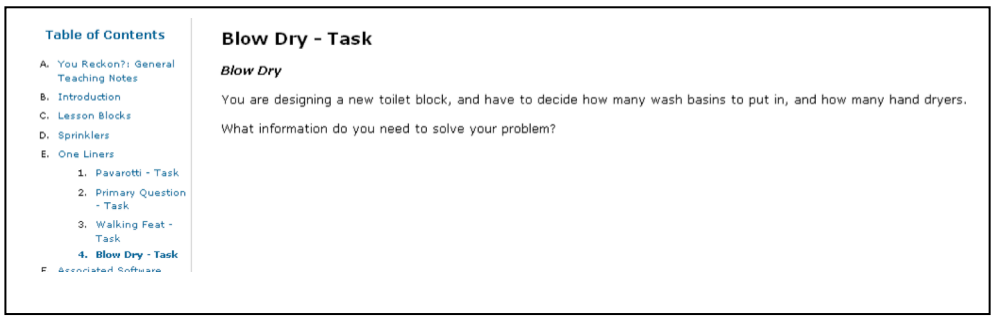
Reviewing other pupils' work may support her understanding of how to produce an effective summary report.





Activity 3: Blow Dry

This activity is to design a toilet block.



Teacher guidance

The provision of a context, eg a cinema, provides an activity is suitable for pupils working at levels 6 to 8.

Observe how well pupils:

- Decide what information is needed and how to use it
- Work towards a solution, and then interpret it
- Present their evidence and conclusion

A useful source is www.hse.gov.uk/contact/faqs/toilets.htm

Questions to ask:

- *What do you need to know to solve the problem? How can you find it?*
- *Do your answers seem realistic? How accurate do they need to be?*
- *Are there any alternative approaches you could have used?*

Assessment guidance: Progression in Key Processes

	Representing	**Analysing**	**Interpreting and evaluating**	**Communicating and reflecting**
PROGRESSION	Identifies relevant questions and how to combine answers	Combines data; takes relevant steps towards the solution	Reaches an informed conclusion	Presents a clear and comprehensive report (oral / written)
	Identifies information needed and has a clear method for solution	Implements a clear and correct method effectively	Reaches an informed conclusion, using appropriate accuracy	As above and shows evidence of reflection, eg that nos. used are estimates
	Selects only info. needed and has a clear and concise method for solution	Implements a clear, correct and concise method effectively Pupil F	As above; processes findings to make them accessible, eg uses % Pupil F	As above; reflects on the limitations surrounding the findings Pupil F
	As above; collects clear data that gives insight into the problem Pupil F	As above; uses a range of appropriate strategies to test findings	As above; critically examines strength of evidence within the detailed solution	As above; gives insightful ways of how the solution could be improved

Sample response: Pupil pair D and E

Comments

These pupils focus on the number of toilets. They explain their choice of 2:1 but not their final solution.

Our cinema

Women need more toilets!

We have to queue but men just go and it is not fair so we are going to give more for women. We thought 2:1 for women: men would be ok and then we did some research and found that that is what the International Building code says so that is what we are going to do.

How many toilets and hand basins altogether?
Our cinema is a little cinema so it is going to have 21 toilets altogether so 14 for women and 7 for men though they can have urinals as well.
There will be 5 hand basins for women and 2 for men.

Probing questions and feedback

- *Why did you choose 2:1 as the ratio?*
- *How did you decide on 21 toilets?*
- *How confident are you that it is a cost effective solution?*

Pupils D and E would benefit from reviewing work done by confident problem solvers who are able to make and justify the assumptions and approximations needed for real life situations – see Pupil F below.

Sample response: Pupil F

Comments

Pupil F created a simple mathematical model to develop a solution.

Loos for the Lovewell Theatre

My assumptions:

- The theatre will seat 450 people.
- Most of the time there will be equal numbers of men and women.
- There will be loos on each of three floors, so they must cater for 150 people.
- The interval is not very long (I will say 15 minutes).
- Everyone who wants to go goes immediately when the interval starts.
- 67% of people want to go during the interval.

I did a survey to find out what people want. I asked 100 people, 50 men and 50 women selected at random in a shopping mall if they thought that theatres catered well for people attending. If not, what would they like improved. 64% of men said nothing, 28% said drinks or food and 36% said seating more comfortable. (It doesn't add to 100% because some said both.) But women were very different and a massive 78% said more toilets proving women need more toilets.
I did some research and found that women take 60 seconds to go to the toilet but men take 35. Walking in and walking out takes longer.
Interval starts time 0 minutes
People leave their seats and start going to the loo time 2 minutes
People finish time 13 minutes to give 2 minutes to get back
That leaves 11 minutes for 50 women to get to the loos. 50/11 = 5 rounded up so 5 loos for women on each floor but for men I did 50x35=1750seconds=29.17mins which is too long. 2 loos gives them 14.48mins but if they have a urinal then it would not be so long. I went to France and they had mixed loos so if we give them 8 loos on each floor it would work well.
If I was doing this again I would check my assumptions because they could change things a lot.

Probing questions and feedback

- *Would your conclusions change if you assumed that people arrive at the loos throughout the interval?*

Pupil F would benefit from learning how to create a simple simulation to model people arriving and leaving. This would enable her to test and extend her outline conclusions.