Mathematics lesson 3 - Teacher notes

Lesson 3 – Teacher notes

Learning aim:

To recognise and interpret graphs and rates of change.

Curriculum links and Skills Builder focus skills chart:

England The national curriculum	Ratio, proportion and rates of change Pupils should be taught to interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion.
Scotland National 5 Mathematics	Algebraic skills Determining the equation of a straight line.
Wales WJEC GCSE mathematics specification	Algebra Construction and interpretation of conversion/travel graphs; recognising and interpreting graphs that illustrate direct and inverse proportion.

Skills Builder Framework Focus Skills

Creativity – The use of imagination and the generation of new ideas	Creativity step 8 I develop ideas by using mind mapping
Problem solving – The ability to find a solution to a situation or challenge	Problem solving step 4 I explore problems by creating different possible solutions.

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Main skills developed and how:

- Interpretation – Students will work together to interpret graphs in context.
- Calculation – Students will calculate straight line graphs and calculate the rate of change of non-linear graphs.

Equipment required:

- Student worksheet
- Answer sheet
- PowerPoint
- Graph paper
- Calculators

Suggested layout of the session:

8 minutes – Go over the lesson aims and then introduce the scenario for the session. A gym instructor runs five spin (cycling) classes per week with 6 members per class. The instructor is always keen to look for ways to better support clients during these classes. As well as asking clients for their direct feedback, she also collects data from the five spin classes, including:

- Time spent at rest.
- Total distance cycled.
- Average speed on the bikes.

She collects the average data from the classes and names them: Group A, Group B, Group C, Group D and Group E.

Using each class, draw a distance, time graph for each group. Identify how long each group cycled for and their length of rest. Students can work alone, in pairs or in small groups. This should be completed on graph paper. The solutions are on the PowerPoint for the students to mark their own.

2 minutes – Facilitate a class discussion. What did they notice about the graphs? Did anything surprise them?

8 minutes - Ask students to calculate the average speed of each class and each part of the journey the classes take. Clarify that some groups have one, two or three parts to the journey and these are separated by the times of rest.

2 minutes – Facilitate a class discussion. What could be affecting the different rates in the classes? Are the graphs realistic? Would you expect constant speed? Which class do you think has the best/most successful 'shape' and why?

There's an opportunity here to discuss direct and indirect proportion. (The longer you cycle for, the more tired you will become. Therefore, you would expect the cyclist to slow down, and this would not be a constant speed, so the graph would not be a straight-line graph.)

5 minutes – Either in pairs or small groups, students should mindmap all the ways that the instructor could change the following:
- Format (for example how long the session lasts for)
- Instruction (for example, how the instructor demonstrates what will happen in class)
- Environment (for example, add up-tempo music at the moments when clients tend to slow)

They should then use these ideas to help them complete the summary findings for each group and recommendations to improve the classes.

How to extend the session – if required:
To extend the class or to set as homework, students could complete the extension activity (included on the student worksheet). To scaffold the activity, as a class you may think of 1-3 example questions that could be included in the survey.

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The instructor wants to know more about how the clients feel about the classes, after making some of the changes you've suggested.
Design a survey that clients will complete on their phones after the class. The survey must include:

- 5-10 questions.
- Questions to better help understand personal motivations for coming to class.
- Ways of gathering information about the format, instruction and environment of the classes.
- Questions that find out the reactions to the changes for the class.

Ways to differentiate:
- Remind students how to calculate the gradient of a non-linear graph.
- Some students might benefit from using the graph with axes and scales already completed.