A six week lesson plan suggestion

We are often asked how to get things going in the Challenge so we have put this document together with the help of several practising teachers and hope you find it useful. Due to the wide and varied curriculum opportunities that the 'Cars Maths in Motion' software presents, we have purposely not tried to cross reference what follows to any National Curriculum/Guidelines document but we can tell you that the project is much enhanced if you divide your group into teams (more information about this and the Challenge on www.mathschallenge.co.uk) As we hope you will discover for yourself, there are so many different things you can do with it, if you want to, you could get close to ticking all the boxes! Please bear in mind that this is only a suggestion – nothing is cast in granite other than having some fun along the way – but the items in brackets relate to the parts of the software where the adjacent skill will be needed.

WEEK 1 – Allow one hour per day

Day 1

Angle measurement (Categorising Track Plans)

Introduce/Revise the correct use of a protractor.
Emphasise the idea of 'counting round' from zero to ensure that students use the correct set of numbers.
Introduce/Revise the vocabulary of acute, right, reflex and obtuse angles.
Give students the opportunity to draw, estimate and then measure angles, gradually refining where necessary.

Where students are not able to use a protractor, the use of templates to measure angles on a 'Greater than/Less than' basis might be an alternative approach. Should this be the case, please refer to each track plan to obtain the appropriate angle sizes from which to make the templates.

Day 2

The concept of scale (Categorising Track Plans)

Use model cars and aircraft to discuss the ratio of scale. (How much bigger is the real thing etc.?)
Using a scale on a map. Find the scale information on single sheet maps and books of maps. (How/Why does this help us read maps?)
Different modes of scale representation - ratio and diagrammatically.
Making and marking a paper 'scale ruler' with an appropriate scale by placing a strip of

plain paper adjacent to the scale diagram.

Using the scale diagram, measure straight (point to point) distances using the scale ruler.

Day 3

Measuring curved lines (Lap Distance)

Use cotton or string to measure the length of curved lines (rivers and roads). Then use the 'paper measuring strip' or the scale diagram on the map to determine the actual distance on the ground.

Day 4

Gear Ratio (Race Planning)

Experiment and collect data on gear ratio. There are many proprietary 'gear' sets available but if you do not have one available, you could use a bicycle and relate the pedal rotations to the wheel rotations.

Day 5

Air Resistance, Drag, Lift and Downforce (Race Planning)

Experiment with the effect of air movement and resistance. Different sizes of parachute and weights of suspended objects.

Hold piece of card directly into the wind, in front of you, until you can 'feel' the resistance. Now turn the card 'edge on' to the wind. What is different, what changed?

WEEK 2

Day 1

Geographical detail and reference books (Location of Circuits)

Introduce students to the country where the race is being held, and its flag. (The race location having been chosen by the teacher/Challenge Organiser's beforehand).
Use reference materials to gather information about different aspects of the country.
How are you going to get there? Modes of transport? How long will it take to travel?

Day 2

Measuring and estimating angles and straight lines (Categorising Track Plans)

Introduce each student to the track plans. Show students the suggested method for drawing the lines (longer than the radius of the protractor makes things so much easier) which will be used to measure angles. Then ask everyone to measure and classify all of the track features, using the strategies that they mastered in Week 1 and the information on the plan. Using the track scale, measure and calculate the distance of one lap around the track. Note all answers on the appropriate Planning Sheet.

Day 3 **-** Continuation/Reinforcement of Week 2, Day 2, is recommended as this is absolutely essential to the success/failure of all 'cars' in the software.

Day 4

Fuel consumption (Pit Team Briefing)

Students should know, or be shown, what 'a litre' actually looks like.
The concept of Inverse Proportion can be introduced at a level appropriate to the age and abilities of the students (As the distance into the race increases, the amount of fuel in the tank decreases etc). Within the project there are only three values needed - Distance, Fuel, Consumption and Fuel Volume.
Use the formula 'Distance divided by consumption = Fuel required' on a series of examples.

Day 5

Fuel consumption (Pit Team Briefing)

Utilise the strategies devised in Day 4 to work out the fuel required for 'the race' - the consumption in 'Cars Maths in Motion' is very often 2 km/litre.
A suggested approach could be:

- Multiply the length of one lap (in kms) by the number of laps in the race to determine the total race distance in kms.
- Divide the answer by 2 (2kms/lt) and the answer is the total amount of fuel needed to complete the race.

- Students do need to realise that, if their answers have a decimal part, they will need to 'round up', as opposed to adopting the 'nearest whole number' rule. This could lead to a discussion about ‘maths in real life’ v ‘maths we teach’ as rounding down the fuel required in any circumstances would result in the car running out of fuel before the end of the race!

WEEK 3

Day 1

Percentage efficiencies (Workshop Adjustments)

Students should understand the concept of ‘percentage’. Show how to work out the percentage of their seven 'Maximum Safe Speeds', using the track plans. This can be done using a calculator, e.g. (82 ÷ 100) x 261 = 214.02 or with pen, paper and some brainpower.

Whole class - Students should be introduced to the software for the first time and shown how to access their cars, select their colours, flag and overalls. They should also be shown ‘How to enter a Race’.

Day 2

Entering speeds and feature classifications (Race Planning)

Enter the safe speeds and feature classifications

Day 3

Probability Mean Speeds and Race Planning.

Students should be shown the 'Race Planning' screen and how to enter the category for every feature and their own safe speeds.

Show students how to carry out a 'Practice Lap'.

Encourage students to consider the possible significance of messages relating to probability and also other messages which appear after successful practice laps. (What does '1 in 10 chance of a crash' really mean in the context of a 50 lap race?)

Encourage students to discuss (within their group) their decisions about ideal speeds for each feature

(a) Give whatever instruction necessary to help any groups who have not yet been able to completed the 'Pre Race' planning in a satisfactory manner.

(b) Show other groups how to copy 'cars' so that they can create up to four cars from the data for the first car - making subtle changes and noting the effects.

Students should be shown how to access the 'Workshop Adjustments' and move the sliders to change the performance percentages. They should be given ample opportunity to experiment with different settings to achieve the best possible combination of percentages. Discussion (within each group) should be encouraged.

Day 4

Pit Team Briefing – Friction.
Look at the weather forecast for the time of the race and study the tyre performance information for different weather conditions.
Experiments can be performed by dragging objects across different flat surfaces, rough, smooth, wet, dry, oily etc.
Enter fuel requirements and select tyres for the cars.

Day 5 Race Day - Note taking. Explain to the students how to take notes of what is going to happen during the race. It should be pointed out that writing suitably spaced lap numbers before the race will aid the rapid noting of relevant information. Point out to students that they will be expected to write an account of the race from these notes.

WEEK 4

Day 1

Report Writing. Teachers should provide 'models of good practice' in report writing by showing newspaper reports from a variety of differing publications. An account of the race just completed - created by the teacher and read to the children, is particularly helpful. Students should write and illustrate their newspaper report of the race.

Day 2

Statistics Students should be shown race reports for a selected number of laps and given instruction in their interpretation. Show how to interpret the 'Race Diagram' for race position, mean lap speeds, weather conditions, fuel state and tyre wear. Show how to extract this information from the program.

Day 3

Comparative Statistics. Students should be given photocopied printouts of their race statistics and those of the race winner - especially the 'Race Settings'. In this way it will be possible for them to draw conclusions about how their performance can be improved in any subsequent races.

Day 4

Spreadsheets. Students should be given access to spreadsheet software into which some lap report data has been loaded. The more able students can be shown how to import this data for themselves from CSV files.

Day 5

Word Processing.
Students can use word processor software to write up refined reports with embedded pictures and other information.

WEEK 5

It is important that students have the opportunity to exercise and develop their newly acquired skills. To achieve this, a second race should be planned on a different circuit. In this second race, an added degree of difficulty should be included. This is a change in the weather during the race. Two changes can be created for older or more experienced students.

Day 1

Time - Estimated Lap Timings - Partial Fuel Loads. Students should be alerted to the following:-

a. The weather will change during the race, suggesting a pit stop to change tyres.

b. They will need to decide on the most suitable tyres after studying on screen statistics.

c. They will need to calculate how many laps will have elapsed before the weather changes.

d. They may decide to only put in enough fuel to take them to the pit stop and then the end of the race.

Students may need to be lead to notice that, for example, the weather can change every 15 minutes and so knowing how many laps will be completed in a 15 minute period is essential. Discuss how many seconds there are in one minute and 15 minutes. Discuss how you find how many laps a car can do in 15 minutes (by dividing 900 seconds by the practice lap time in seconds). The students should work on examples.

Days 2- 5

Students go through the various stages outlined earlier - but with a greater level of independence. This should allow all work to have been completed by Day 5, when the race can be held. Because of the increased level of independence of the students, the teacher will be able to spend more time helping the less able and encouraging more able students to undertake a wider range of mathematical experimentation within the context of the project.

WEEK 6

A third race can be planned with a complex track and more than one change in the weather.

For able students, electronic calculators can be banned. Students can be expected to carry out the various tasks with a greater degree of confidence and competence - secure in the exercise and understanding of the various mathematical skills that are part of 'Cars Maths in Motion'.