Name: Class:

STEM Project

Chapter 1: Science toolkit

Pages 1–16

Reverse engineering: starting at the end

Have you heard the term ‘reverse engineering’? Reverse engineering is when you figure out how to reproduce something by taking apart a finished example to study. You start with the finished product and work backwards to determine the steps involved in making it.

You have already learnt about the scientific method and how to record this method in a scientific report. Usually you start with an aim and a hypothesis, then you document your materials and the method involved, and finally you record the results and make conclusions.

In this task, you are going to use the idea of reverse engineering to design a scientific experiment by starting with the results and working backwards to create the experiment that could have obtained them.

Starting with results

Below is a table of results from a scientific experiment. The results measure the effect of certain modifications on how far a paper plane flies.

Results table: The effect on flight distance of modifications to a basic paper plane design

Flight distances (in metres)	Basic plane design	Modification 1: Wing flaps	Modification 2: Flattened nose
Trial 1	11.2 m	11.0 m	8.7 m
Trial 2	13.4 m	15.3 m	7.5 m
Trial 3	9.8 m	14.5 m	8.2 m
Average distance	**11.5 m**	**13.6 m**	**8.1 m**

Creating the experiment

Using these results, work through each section of the scientific method to create an experiment that could have obtained these results.

Title: Give your experiment a title.

Aim: Describe what you think the purpose of this experiment could have been.

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Name: Class:

Hypothesis: What guess or prediction could have been made?

Equipment: List the equipment that would have been required to carry out this experiment.

Method: How would this experiment have been carried out?

Start by defining the variables involved in the experiment:

Independent variable:

Dependent variable:

Controlled variables:

Now write down the steps that would have been taken to conduct this experiment. Don't forget to include any instructions needed to make sure the experiment is safe.

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Name: Class:

Results: The results of the experiment are provided in the original table. To better understand trends and relationships in results data, it is often helpful to display it in a graphical format.

Choose an appropriate graph type to display the results from the table and draw it in the space below.

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Name: Class:

Discussion and conclusion: What do the results tell you?

Analyse the results in the table and graph and make some comments about what you notice. Write down any conclusions you can make regarding your hypothesis based on the results.

What could be the next steps for a scientist trying to discover the aim of this experiment. Recommend some further areas that could be investigated to find out more and/or validate the results.

Discussion and reflection

Describe any variables that you think would be difficult to control in this experiment. Why would they be difficult to control?

Do you think there were enough trials carried out in this experiment to make the results reliable? Why/Why not?

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Name: Class:

If another scientist repeated this experiment, how similar would their results be?

Extension activity: Reverse engineer a toy

Find an old child's toy that involves mechanical moving parts, such as a wind-up toy.

Disassemble the toy by removing the screws and opening the casing to see how it works inside. As you remove each part, note down what you have removed and from where.

Once it is disassembled, draw a diagram showing how it works.

Finally, see if you can put the toy back together in working order.

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