

# Teaching the Scientific Method

## START WITH A QUESTION

Which baking powder will cause a cake to rise higher?

## PLAN THE INVESTIGATION

Think about how you would conduct this experiment.

**How** many cakes would you have to bake?  
**What** would be different each time?  
**What** would you be looking for?  
**When** will you do the experiment?

**How** will you take the measurements?  
**How** will you record the results?  
**Where** will you perform the experiment?  
**What** apparatus will you need?

## CONVERT THE QUESTION INTO AN AIM

An aim always starts with '**TO**'

**To** determine ...  
**To** investigate ...  
**To** compare ...

**To** determine which baking powder will cause a cake to rise higher.

The aim will always have two variables: the **independent** and **dependent** variable.

## UNDERSTAND & IDENTIFY THE VARIABLES

A **variable** is something that can change.

Dependent variable

- changes because of the independent variable
- it is what is being **measured**
- happens second

*What are we measuring?*

**The height of the cake.**

Independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

*What does the height of the cake depend on?*

**The type of baking powder.**

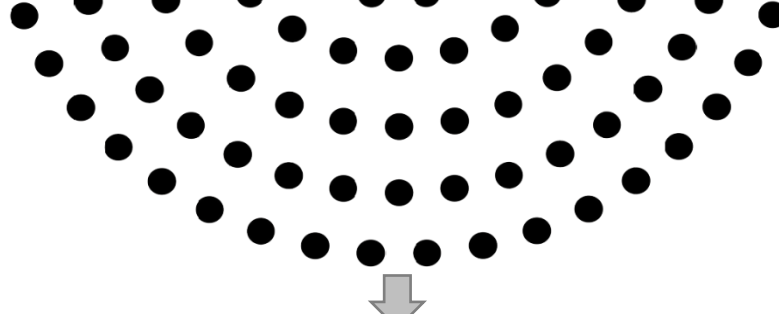
**What other factors could influence the height of the cake?**

Constant/  
Fixed/  
Controlled  
variables

- can affect the results of the investigation
- must be controlled so that they do not interfere
- also known as **fixed** or **controlled** variables

same size/brand/age/type of eggs  
 same amount/brand of flour  
 same amount/brand of sugar  
 same volume/temperature of water  
 same volume/brand of vanilla  
 same amount/brand of butter

same oven, at the same temperature  
 same sized cake pans  
 same baking time  
 placed in the oven at the same time  
 same amount of each baking powder



## VALIDITY

**Validity** refers to whether the investigated tested what it **aimed** to test.

- If you do not keep unwanted variables constant, you would not know which variable caused the difference in the height of the cake.
- This would cause the investigation to be invalid, since there are too many variables to know which one caused the dependent variable to change.



## WRITE A HYPOTHESIS

Requirements for a hypothesis:

1. must contain the **independent** and **dependent** variables
2. a possible **prediction/explanation** of the relationship between two variables
3. a **statement**
4. **testable**

There are many different versions of a given hypothesis, as long as the four requirements are met. This makes it difficult to examine hypotheses. Memoranda must therefore be sensitive to all the different options.

A hypothesis can be stated **positively**.

'Best' baking powder will cause the cake to rise higher than 'No Name' baking powder.

A hypothesis can be stated **negatively**.

'Best' baking powder will **not** cause the cake to rise higher than 'No Name' baking powder.

BUT it is always best to state a **general** hypothesis

The **type of baking powder** will affect the **height of a cake**.

OR

Different **types of baking powder** will affect the **height a cake rises**.

**independent variable**

**dependent variable**



## COLLECT YOUR RESULTS

Type of baking powder	Height of the cake (cm)
'No Name'	15
'Best'	20

Use the appropriate measuring apparatus.

Organise the data into **tables** or **graphs** (whichever best represents the specific data).

## MAKE A CONCLUSION

Study the results and look for a general relationship that can be deduced.

Refer back to the **hypothesis\*** to make a conclusion.

**'Best'** baking powder caused the cake to rise higher than **'No Name'** baking powder.

**\*Be careful of merely quoting the results and rather state a relationship that can be observed between the variables.**

## RELIABILITY

**Reliability** refers to whether the results of an investigation are **trustworthy** and **consistent**.

<b>1</b> <b>Repeat</b> the investigation	Can confirm whether your results are consistent
<b>2</b> Calculate an <b>average</b>	Can provide results that can be generalized to a larger group/phenomenon
<b>3</b> Take a <b>random</b> sample	Removes the experimenter's bias
<b>4</b> <b>Increase</b> the sample size	Provides more data that can be used to calculate an average OR generalize the results

## THE CONTROL SETUP

The control setup provides a **comparison** with the experimental results.  
It **confirms** that the independent variable caused the results.

In the control setup we remove the independent variable to compare its effect.

The control would have all the same ingredients as the other two cakes, but **NO** baking powder.