

STEM Boats

This session is focussed on effective use of variable control when investigating in science. Using the 'Post It' method, pupils will identify the variables in a given context and develop an understanding of which ones to control and which ones to measure. The context for this work centres on wind power in a form that children will be familiar with. It can be adapted to using kites, creating parachutes to drop an object from a height, sail powered cars and anything where air resistance affecting motion can be applied.

KEY QUESTIONS: What is a variable? How can we use knowledge of variables to create controlled, fair tests?

1) IDENTIFYING VARIABLES

Using the examples provided on the accompanying materials, ask the children to identify all the things that *could* change in each situation. This can be a whole class discussion but likely organised as a 'prompt, children work in pairs, feedback' session. There is a teacher crib sheet to help prompt the discussion. For many classes coming to this for the first time, they will improve their skills and ability to identify variables (and think of odd ones!) as the session progresses.



2) AIR RESISTANCE

Ask for a volunteer. Give them a piece of A4 paper. Ask the rest of the class to quickly draw an experiment using the volunteer and paper to see how long it will take for the paper to drop to the floor (example supplied). Ask them to identify the variables. After some feedback and discussion show the children the 'Post It' planner, ideally give the children one each or use the digital version. Demonstrate how the variables all start on the diagram but then are moved to show how they must be considered as change/measure/control (short video demonstration supplied). Ask for another volunteer and give them a piece of A4 paper too. Ask them to scrunch up the paper into a ball. Can the class adapt their variables on their planners to allow for this new variable? What do they think will happen when the paper is dropped? What has caused the different result? Discuss feedback and focus on: friction and air resistance. Watch the BBC video about air resistance (link to the right).

<https://www.youtube.com/watch?v=r9lwc5bRUFw>

3) AIR RESISTANCE AS POWER

Discuss the idea that the air can act as a force on objects. Depending on the class this may also link into work on solids liquids and gases. The video linked to activity 2 also includes animations to help understanding. Put a fan or hairdryer on a desk and point it upwards. Ask a volunteer to hold a piece of paper above it. What will happen when the paper is dropped if a) the device is left switched off or b) the device is switched on? Discuss then demonstrate. How can this force of air moving be useful? The video to the right can draw the discussion to the role of wind farms such as Dogger Bank and the link below it allows a quick exploration of what it is, and where it is, if teachers want to do more work on it. Can children think of other uses of wind power? Lead the conversation to sails! Show the bottom video on the right, it links sail power and wind farm energy in a short explanation.

Ask the children to think of a way that they could test sails to see which is most effective. Show them the foil trays and drainpipe 'test track'. Can they sketch the experiment and add the variables?

Key variables that they could change:

- Size of sail
- Shape of sail
- Material for sail
- Position on boat of sail

It is up to the children which they test along with availability of materials. Use the Post It planner to plan the experiment and children undertake it. Below are links to examples and resources required. Ideally the children will work electronically using the Keynote version. But print out and PPT versions are also included for teachers with restricted access.



<https://youtu.be/JGET8pWISq4>

How wind power can help the world.



<https://earth.google.com/earth/d/1fzJ2Qw6iLZOJBQir-wmz322halmAURjB?usp=sharing>

The Google Voyage explores the Sofia Wind Farm.



https://www.youtube.com/watch?v=niZ_cvu9Fts

Wind power

Question: How does the size of a sail affect how long it takes a boat to complete a journey from A to B?		Results: <table border="1"> <thead> <tr> <th>Size of sail</th> <th>Time taken</th> </tr> </thead> <tbody> <tr> <td>10cm sq</td> <td></td> </tr> <tr> <td>20cm sq</td> <td></td> </tr> <tr> <td>30 cm sq</td> <td></td> </tr> <tr> <td>40 cm sq</td> <td></td> </tr> </tbody> </table>		Size of sail	Time taken	10cm sq		20cm sq		30 cm sq		40 cm sq					
Size of sail	Time taken																
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Experiment diagram: 		This has identified variables from before your sail size and graph case if posting results. So copy and paste across. There is more time to run and record each experiment in number of times for added reliability of conclusions (if any). You may ask children to add a table to improve time to testing sails.															
Variables that could change: <table border="1"> <thead> <tr> <th>Boat size</th> <th>Height of mast</th> </tr> </thead> <tbody> <tr> <td>Way of release</td> <td>Depth of water</td> </tr> <tr> <td>Length of journey</td> <td>Boat shape</td> </tr> <tr> <td>Wind source</td> <td>Size of sail</td> </tr> <tr> <td>Timer</td> <td>Boat material</td> </tr> <tr> <td>Sail material</td> <td>Position of sail</td> </tr> <tr> <td>Person timing</td> <td></td> </tr> </tbody> </table>		Boat size	Height of mast	Way of release	Depth of water	Length of journey	Boat shape	Wind source	Size of sail	Timer	Boat material	Sail material	Position of sail	Person timing		Conclusions: Answer the question but also add any new information that you discovered and generally what else they could have tried to test.	
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Way of release	Depth of water																
Length of journey	Boat shape																
Wind source	Size of sail																
Timer	Boat material																
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Variable we will change: Size of sail		How could I make the experiment more accurate? Very important to reflect on limitations of all of any from above to improve next time but ask our value how confident they are in their conclusion.															
Variable we will measure: Time taken																	

[Post It Planner for children \(on iPad\)](#)

[Post It Planner print out version](#)

[Post It Planner help for teachers](#)

[PPT version of Post It Planner](#)

