

Think like a scientist! – Learn how to plan a plant based experiment

KS3 & 4 RHS Wisley lesson plan

QCA: 'How science works' - selecting equipment and methods, controlling variables, recording, concluding and evaluating.

Every Child Matters: main areas covered: *Stay Safe* 2.3; 2.4 *Enjoy & achieve* 3:6 *Make a positive contribution* 4.2; 4.3; 4.4



<i>Learning Objectives</i>	<i>Structure</i>	<i>Plenary</i>
<p>Students should learn:</p> <ul style="list-style-type: none"> • That plants need sources of nitrogen and other elements in the form of minerals. • That mineral deficiency hinders plant growth. • That fertilisers supply these minerals to crop plants. • About environmental factors that influence plant growth. <p>Students should be able to:</p> <ul style="list-style-type: none"> • Identify ideas that can be investigated. • Choose an 	<p>Introduction</p> <p>Discuss which sort of questions can be investigated scientifically e.g. which plants are most beautiful for the garden? Which varieties of plants grow well in the garden? (Name /show pictures of plants in the trails field). Which minerals are needed for healthy plant growth? Choose an appropriate strategy for investigating the investigation identified.</p> <p>Discuss variables – which can be controlled and which need to be taken into account. E.g. plant trials – planted in same soil, subjected to same weather conditions, same spacing between plants and same regime of watering. Think of variable which may affect the growth of plants which cannot be controlled – attack by pests.</p> <p>Activities</p> <p>1. Trials Judges Activity:</p> <p>Start with a visit to the trial ground. Look at a trial in progress and discuss how it was set up and how it will be judged. Does this follow our experimental design ideas, if not how might it be altered?</p> <p>Record ideas. Decide which criteria need to be used to judge which variety is 'best'. Have a look at the plants in the trial and decide which one/ones they as judges would think is worthy of a RHS Award of Garden Merit.</p> <p>Return to classroom.</p>	<p>Describe the different methods used in today's investigations. What are the similarities and differences in the methods used?</p> <p>How could the method used for the mung bean water culture experiments, be made as reliable and accurate as possible, to be able to draw valid conclusions?</p>

<ul style="list-style-type: none"> • appropriate strategy to record measurements. • Consider what other factors, including those that cannot be controlled, might affect the results and how to deal with them. • Collect and record data appropriately. • Evaluate the limitations of the evidence by considering sample size and the possible effect of other factors. • Use scientific knowledge and understanding to interpret results. 	<p>Presentation/discussion on experimental planning, including the accuracy and validity of their results. Evaluate the limitations of the evidence by considering sample size and the possible effect of other factors.</p> <p>2. Water cultures – Mineral Nutrition in Plants Experiment</p> <p>Discuss environmental factors that influence plant growth. Focus on mineral requirements. Ask pupils why farmers put fertilisers on fields. Provide boxes of plant fertiliser for pupils to explore the ingredients listed. Discuss why plants need certain minerals, <i>e.g. nitrate and potassium</i>, for healthy growth.</p> <p>Referring to NPK fertilisers, ask for suggestions of how to design an experiment to show that nitrogen, potassium and phosphorus is needed for healthy plant growth. Discuss variables and need for a control. Could demonstrate an experiment already set up. Variables to control: light, temperature, water. Why use distilled water?</p> <p>Water culture – one with all nutrients, one with nitrogen missing, one with potassium missing, one with phosphorus missing, one with only distilled water – all nutrients missing.</p> <p>What are you going to measure/observe to be able to come to a conclusion? Could discuss usefulness of measuring ‘dry mass’.</p> <p>Pupils provided with the materials to be able to set up experiment at school? For the more able students provide secondary data. Pupils draw conclusions from secondary data.</p> <div data-bbox="647 1059 1675 1254"> <p>Key vocabulary:</p> <p>Nutrient, fertiliser, water culture, scientific method, developing a technique, controlling variables, fair testing, evaluation, reliability of data, validity of conclusions, bias</p> </div>	<p>Resources: (Check trials field)</p> <p>Clipboards Pencils, paper, tape measurers Empty boxes of plant fertilisers (photocopies of boxes showing mineral contents) Mung beans - moistened and left in a warm incubator for a few days. Standard Sachs solutions (from Phillip Harris) Complete Culture, minus N, minus P, minus K Distilled water Foil or clingfilm Boiling tubes/ jars (Sheets of secondary data)</p>
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<p>Assessment questions</p> <p>How scientific is the method used for judging plants on the trials fields? How do you think that the methods of using trials fields could be improved?</p> <p>Why do plants need mineral nutrients? Can you name a mineral nutrient that plants need? Why do plants need nitrogen?</p> <p>How scientific do you think the water culture method is?</p>	<p>Ref: http://www-saps.plantsci.cam.ac.uk/journals/hp.pdf (<i>Plant Mineral Nutrition in the Classroom</i> J Hewiston and R Price) http://www-saps.plantsci.cam.ac.uk/docs/hsw/2.Plants and Minerals/2dry_data_mung_beans_in_mineral_solutions.xls (Secondary Data) http://www-saps.plantsci.cam.ac.uk/docs/hsw/5_tech_details/tech_details_4_mung_beans.doc (Technical details for mung bean investigations)</p> <div data-bbox="622 408 1720 1284" style="border: 1px solid black; padding: 10px;"> <p>Differentiation:</p> <p>All students select suitable equipment, decide on and use methods that are adequate for the task. Make observations and measurements which are recorded in tables. Relate their conclusions to their observations and to scientific knowledge and understanding. (Level4)</p> <p>Most students identify an appropriate approach to the investigations selecting and using sources of information provided. Select and use methods adequate to the task. Identify the need to repeat measurements and observations. Record their data effectively. Analyse findings to draw conclusions consistent with the evidence and use scientific knowledge and understanding to explain them and account for any inconsistencies in the evidence. They communicate qualitative and quantitative evidence effectively. They evaluate evidence, making reasoned suggestions about how their working methods could be improved. (Level 6)</p> <p>Some students recognise that different strategies are required to investigate different kind of scientific questions and select an appropriate strategy. Record data with the precision and reliability needed. Analyse data and begin to explain and allow for anomalies. Communicate findings and arguments showing awareness of a range of views. Evaluate evidence critically and suggest how inadequacies can be remedied. (Level 8)</p> </div>	
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