Seasonal Leaf Changes/Differences Inquiry Project
Supplementary Learning Activity

Purpose
- To increase student awareness of changes/differences in/among leaves other than color and size
- To provide students with an opportunity to conduct an inquiry on the leaves in their local environment

Overview
Students will observe leaves looking for changes/differences that might be associated with particular seasons or environmental conditions and then work in groups to develop testable/researchable questions for their inquiry.

Time
Three to five class periods

Level
Beginning, Intermediate, Advanced

Key Concepts:
- Plants experience changes other than size and color
- Changes/differences are the result of a variety of factors including disease, insect damage, weather, etc.
- Sometimes these changes/differences can be associated with particular seasons
- Changes can be both temporal and/or spatial

Skills
- Observe
- Measure
- Collect data
- Analyze data
- Infer
- Graph

Materials
- Hand lenses (2 per group)
- Rulers (1 per group)
- Lighted microscopes
- Cm grid sheets (1 per group)
- Large clear packing tape (1 per group)

Procedure
Gear up
- Ask students to get in small groups and brainstorm together and list:
  - Changes/differences they have observed in their local environment (for example, changes or differences in plants, animals, land, etc.)
  - Changes/damage they have observed on the leaves while doing phenology
  - Any inferences they have about what could have caused the change/damage

Explore
- (It is important to provide unstructerured explore to give students the opportunity to develop good inquiry questions)
• Send students outside
• Have each person collect three leaves that have evidence of change/damage
• Challenge them to try to find leaves that appear to have changed or been damaged differently
• Back inside have each group pool their leaves and fill in the chart on page 4 together

**Generalize**
• Ask each group to share an important observation, inference and a question they had
• Put concept circle on board or chart with “Leaves” in the center (see Leaf Pigment Investigation, page 2)
• Draw spokes around the outside of the circle and have students supply observed change/damage (evidence)
• Next draw a line from each observed change for each possible (inferred) cause. Question students to elicit any missing variables that might need to be considered
• Next have students work in small groups to develop their inquiry questions.
• Remind students that Inquiry questions can be answered by any or all of the following procedures:
  • Hands-on investigation/experiment
  • Researching in books or on Internet
  • Consulting experts

**Investigation/Inquiry**
Have students work in groups or individually to:
• Refine their testable or researchable question
• Develop the procedure through which they will gather data
• Collect data
• Analyze their data to determine results
• Interpret the data to determine implications
• Communicate findings

**Assessment**
Rubric following
## SAMPLE SCIENTIFIC INQUIRY SCORING RUBRIC

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Developing</th>
<th>Proficient</th>
<th>Exemplary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing Questions</td>
<td>Is unable to develop testable or</td>
<td>Develops questions that are testable or</td>
<td>Uses observations and scientific knowledge to</td>
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<tr>
<td></td>
<td>researchable question</td>
<td>researchable depending on situation</td>
<td>develop testable and researchable questions</td>
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<tr>
<td>Designing Investigations</td>
<td>Is unable to develop a plan for a</td>
<td>Develops a plan for a simple investigation</td>
<td>Plans a simple investigation to answer the</td>
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<td>simple investigation to answer the</td>
<td>to answer the question with very little</td>
<td>question that includes orderly, safe and</td>
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<td>question</td>
<td>assistance</td>
<td>workable procedures</td>
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<tr>
<td>Conducting Investigations</td>
<td>Requires assistance to conduct</td>
<td>Conducts investigations with some assistance</td>
<td>Conducts investigations with little or no</td>
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<td></td>
<td>simple investigation</td>
<td>from teacher</td>
<td>assistance from teacher</td>
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<tr>
<td></td>
<td>Data gathering is inconsistent,</td>
<td>Data appears mostly accurate and complete</td>
<td>Data appears is accurate and complete</td>
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<td></td>
<td>inaccurate or incomplete</td>
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<tr>
<td>Analyzing and Interpreting Data</td>
<td>Analysis and interpretation are not supported by the data collected</td>
<td>Analysis and interpretation of data are supported by the data</td>
<td>Analysis and interpretation of data are supported by the data New insights are provided</td>
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<tr>
<td>Communicating</td>
<td>Is unable to clearly communicate explanation of the investigation. Findings were unclear.</td>
<td>Clearly communicates explanation of the investigation. Findings are mostly clear</td>
<td>Clearly communicates explanation of investigation in a variety of ways (written, spoken, drawn). Findings are clear</td>
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Leaf Differences/Changes Record Sheet

<table>
<thead>
<tr>
<th>Leaf number</th>
<th>Observations (Use four senses and measurement)</th>
<th>Inferences (Why do you suppose..?)</th>
<th>Predictions (What will happen if I …?)</th>
<th>Questions that Come up during the Investigation</th>
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