Generating and Testing Hypotheses

Involves application of knowledge

Many application in Food Science

- What happens if…
  - More liquid is added
  - More dry ingredients are added
  - Muffins are stirred
    - just until mixed
    - Until batter is lumpy
    - Until batter is smooth and shiny

Deductive thinking

- Using a general rule to make a prediction about future action or event

- The more gluten is manipulated the longer and stronger the gluten strands become.
  - Thus when muffins are stirred until the batter is smooth and shiny, they will become?
Inductive thinking

• Process of drawing new conclusions based on information we know or are presented with.

• Students must first discover the principle from which the hypothesis is generated.
  – Develop gluten balls
  – Hypothesize what will happen to flour mixtures.

Deductive techniques

• Have much larger effect sizes

• Inductive techniques .48 ES
• Deductive techniques .83 ES

• Inductive strategies need to have well-orchestrated set of experiences so students can infer accurate and appropriate principles.

Deductive is probably better

• Present principles directly
• Ask students to generate hypothesis
Hypothesis and Conclusions

- Preferable to have students explain in writing
  - the principles they are working from
  - the hypothesis generated from the principles
  - Why the hypothesis makes sense.

Scientific Method

- Generating and testing hypothesis
- Other types of tasks can employ hypothesis generating and testing

Systems Analysis

- Purpose of system
- Parts of the system
- Functions of each part
Classroom Practices

- For generating and testing hypothesis
  - Systems analysis
  - Problem Solving
  - Historical Investigation
  - Invention
  - Experimental Inquiry

Systems Analysis

- Family System
  - Explain purpose of system, parts of system, function of each part
  - Describe how parts affect each other
  - Identify a part of the system, describe a change in that part
    - Hypothesize what would happen as a result of this change
  - When possible, test your hypothesis

Other Systems

- Digestive System
- Reproductive System
- Heating and Cooling Systems
- Household Plumbing System
- School System
- Food Transportation System
- Soccer Match
- Aquarium/Terrarium
Systems Analysis Graphic Organizer

- How to access a web site

Systems Analysis Template

- My hypothesis about what will happen
- I think this will happen because
- After I completed the systems analysis, I found
- As a result of doing this task, I learned

Example

- How is the classroom like a system? Define the parts, function of each part, and the purpose
- Write a paragraph that explains how the parts affect one another—how students interaction, how teacher affects students, how an interruption affects the classroom system.
- Imagine a change in the system – i.e. a student assistant will be available
- Make a hypothesis about what will happen as a result of the change
- Describe a possible scenario in which you “test” the hypothesis.
Problem Solving

• By definition problems are messy
• They involve obstacles and constraints.

Problem Solving

• Stop the Violence FCCLA Program
• Develop a business plan for establishing after school care for students
• Plan and conduct a “Family Cultures Fair to celebrate and promote diversity in the community
• Research funding and local programs available to low-income families to discover how much money these families have for food each week.
• Create a business offering quick and inexpensive breakfast foods for students

Problem Solving Steps

• Identify the goal to be accomplished
• Describe barriers or constraints that keep you from reaching the goal
• Identify different solutions for overcoming constraints
• Hypothesize which solution will work
• Try your solution
• Explain whether your hypothesis was correct, or try something else.
Will students develop a graphic organizer?

Problem Solving Results Template

• My hypothesis about the best solution is …

• I think this idea will work because…

• After I completed the problem-solving process, I found…

• As a result of doing this task, I learned…
Planning Sheet for Problem Solving

- What knowledge will students be learning?
- Do I need to set aside time to teach students the process? How will I teach them the process?
- Will I ask students to use a graphic organizer?
- How much guidance should I provide students?
- How will students explain their hypothesis and communicate their conclusions?
- How will I monitor how well students are doing with problem solving?
- What will I do to help students who are not problem solving effectively?

Decision Making

- What is the purpose of asking students to make decisions

- What kinds of decision-making activities do I use with my students?

- What questions might students have about this method.

Graphic Organizer for Decision Making

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Kobe Bryant</th>
<th>Bill Clinton</th>
<th>George Bush</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Responsibility</td>
<td>Adheres to moral principles</td>
<td>Respects rights of others</td>
<td>Honest</td>
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<td></td>
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Best Citizen: who best fulfills their personal and civic responsibilities?
Graphic Organizer for Decision Making

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What is the most important communication mechanism invented?
Using the decision-making matrix to get started and then add your own criteria

<table>
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<th>Criteria</th>
<th>Alternatives</th>
</tr>
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<tbody>
<tr>
<td>% of people affected</td>
<td>Telephone</td>
</tr>
<tr>
<td>Accessibility</td>
<td></td>
</tr>
<tr>
<td>Cost for basic service</td>
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• What issues arose and engaged in this decision-making task?
• What insights did you gain about the decision-making process?
• What knowledge would students need to do this task?

Results Template - Decision Making

• My hypothesis about the best solution is …

• I think this idea will work because…

• After I completed the problem-solving process, I found…

• As a result of doing this task, I learned…
Planning Sheet for Decision Making

• What knowledge will students be learning?
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Historical Investigation

• Use when you want students to construct and investigate a plausible scenario for an event from the past about which there is no general agreement.
• Should grow out of confusions or contradictions found in information available about the topic.
• Students use available resources to construct a resolution to the confusions.

Recommendations for classroom practice

• Give students a model for the process.
• Use familiar content to teach students the steps for historical investigation.
• Give students graphic organizers for the historical investigation.
• Guide students as needed.
• Ask students to explain their hypotheses and conclusions.
Model for Historical Investigation

• Clearly describe the historical event
• Identify what is known or agreed upon and what is confusing or contradictory
• Offer a hypotheses
• Seek out and analyze evidence to determine if you hypothetical scenario is plausible

Example Historical Investigation

• "A Child Called It"
  – Clearly describe the historical event
  – Identify what is known/not known/controversial
  – Offer a hypothetical scenario
  – Seek out/analyze evidence to determine if your hypothetical scenario is plausible

George Washington and the Cherry Tree

<table>
<thead>
<tr>
<th>Concept or Scenario: Did George Washington chop down the cherry tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known or Agreed Upon: The story is meant to teach Children a lesson.</td>
</tr>
<tr>
<td>Confusions or Contradictions: Other stories exist, too</td>
</tr>
<tr>
<td>Specifics: The story about George Washington Chopping down a cherry tree was published in a book by Mason Locke Weems in 1809. George Washington was a popular figure and many stories were told about him.</td>
</tr>
<tr>
<td>Specifics: There was a story about his mother’s favorite colt dying while George was riding it. George told the truth &amp; did not try to hide the fact that he had been riding the colt</td>
</tr>
<tr>
<td>Resolution: The cherry tree story was probably made up, but the important part of the story is what matters. It is meant to teach children to tell the truth.</td>
</tr>
</tbody>
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Food Science

- Sugar Crystallization
- Varying ingredients
- Petri dishes and contaminates in kitchens, hair, hands, dish clothes, etc.

Tips for helping students generate hypothesis and explanations

- Provide with templates for reporting work
- Provide sentence stems to help articulate explanations
- May audio tapes of students explaining their hypothesis and conclusions, or reinforce writing skills and vocabulary with written work.
- Provide rubrics so students know criteria on which they will be evaluated for their explanations
- Provide external audiences (parents, community members) to ask students to explain their thinking.