How To: Use Experimental Inquiry Tasks

DQ4: HELPING STUDENTS GENERATE AND TEST HYPOTHESES

Element 22
Strategies for Engaging Students in Cognitively Complex Tasks Involving Hypothesis Generation and Testing

Lessons that involve generating and testing hypotheses are student directed. They require the student to apply what has been learned thus far to extend their thinking on a given topic. The teacher should act as a guide, ask clarifying questions and provide resources to the students.

The first step in an experimental inquiry task is to make a prediction. The second step is to design a way to test that prediction (e.g., observations, surveys, experiments, questionnaires and interviews). After the data is collected the student examines the results and compares it to the original prediction made. The guiding questions the teacher might ask for an experimental inquiry task are listed below:

1. What is my prediction?
2. How will I test my prediction?
3. What do I expect to see if my prediction is accurate?
4. What actually happened?
5. Did my prediction come true?
6. How has my thinking changed about the situation?

An Experimental Inquiry template using these guiding questions has been provided at the end of this discussion.

Example experimental tasks:
Math (Middle): Experiment with different ways to multiply two and three digit numbers. Predict what would happen if you multiply each number by the one underneath it. Solve a few problems using this strategy then compare the new strategy’s answers to the answers you get using the traditional algorithm or the calculator. What do you notice? Was your prediction correct? If not, why do you think the answers are different? If the answers are the same, why (how) did you get the same answer using different strategies?

Language Arts: Predict how your peers would respond to the following question, “Should we be required to wear uniforms in school?” Collect data using interviews, questionnaires or surveys to test your hypothesis. Compare your original prediction to the results collected. (Another example – “How do advertisements influence our decisions?” Conduct a test to determine if advertisements influence decisions your class makes.)
Social Studies: Interview or survey members of different generations about their attitudes about the economy. (Different areas of interest based on the content studied could be used as the topic like war, cultural norms, and the current political campaign.) After your investigation, test your original predictions about the generational attitudinal differences and similarities against the patterns revealed in the data collected. (Secondary example) During a unit that focuses on the social upheaval (mindset, customs and morals of Americans) during the 1960’s, ask the students to predict how liberal the teenagers of that timeframe would be today? In other words, did living through such a liberal era when they were teenagers (considering the formative years) have any impact on whether or not those people are still liberal today or would the fact they grew up in a liberal period have no impact on their current behavior? Remembering that these teenagers are now 50 to 60 years old, the students would need to determine and develop a way to collect information (survey, questionnaire, etc.), collect the data, and analyze the data to see what hypothesis it supports. When they report their findings they would need to explain the process they used to collect information, describe whether or not the data supports their hypothesis and explain any changes in their thinking that occurred because of this task.

Math (Elementary): After practicing and developing fluency with three column addition, ask the students to predict how changing the order of the steps or the steps themselves would affect the ease or difficulty of solving the problem correctly. Once these predictions are made, the students should experiment with various addition problems to collect the data necessary to determine the accuracy of their prediction.

Physical Education (Secondary): During a unit on tennis, after the students have the basics down and they understand how to hit a ground stroke in tennis, ask the students to predict and then determine how a slight change in their hand position or stance would affect their serve. (Another example: “How does the way you position yourself affect how you can receive and pass a (basket, base, foot) ball? Have the students make predictions and test them.)

Music: How does the way you hold your instrument change how it sounds? Make some predictions and test them?

*Many of these examples came from The Art and Science of Teaching (Marzano, 2007) and A Handbook for the Art and Science of Teaching (Marzano & Brown, 2009)
### Experimental Inquiry

<table>
<thead>
<tr>
<th>Question</th>
<th>Space for Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is <strong>my prediction</strong>?</td>
<td></td>
</tr>
<tr>
<td>How will I <strong>test my prediction</strong>?</td>
<td></td>
</tr>
<tr>
<td>What do I <strong>expect to see</strong> if my prediction is accurate?</td>
<td></td>
</tr>
<tr>
<td>What <strong>actually happened</strong>?</td>
<td></td>
</tr>
<tr>
<td>Did my <strong>prediction come true</strong>?</td>
<td></td>
</tr>
<tr>
<td>How <strong>has my thinking changed</strong> about the situation?</td>
<td></td>
</tr>
</tbody>
</table>