GMS: Science December 8, 2016

**The Question is the Thing**

Part I: Questions and Self Reflection

Part II: Different Question Models

1. Scientific Method

B. Integrative

C. RAFT

D. Numbered Heads Together

Part III: Dare to Disagree

Part IV: Assessment: Pop Quiz

Part V: Essential Questions and Critical Thinking

Part VI: Impatient Problem Solving

All Materials on Website, <http://mattersofeducation.org/workshop_materials/guilmette-science/>

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**Part I: Questions and Self Reflection**

1. As you watch this teacher, please note

What questions does she ask and

1. What is the objective of this lesson?
2. what do you conclude about her as a teacher from these questions
3. what message does she convey to her students by these questions

B. Now it’s YOUR turn. (Learning Strategy: Pair-Share)

1. Identify a question that you ask frequently in your role as an educator
2. Share it with a partner.
3. As you do so, please consider
4. your short term objectives
5. your long term goals
6. what someone might conclude about you as an educator based on this question

**Part II: Different Question Models**

A. Integrative

|  |  |
| --- | --- |
| **TEXT DEPENDENT**  Question can be answered using everything ‘in front of you’—the book, the problem, the experiment… | **TEXT EXTENDER**  One hand on the text, the other reaching out |
| **ANALYTIC**  Brings together several pieces—but posed BY THE TEACHER… | **CREATIVE**  Also brings together several pieces, but generated BY THE STUDENT and demonstrates internalization of the concepts/ideas taught |

KEY POINTS:

· Not necessarily a progression

· Often dependent on one another

· Big Goal: Student Interaction, Cooperative Learning, Checks for Understanding

1. Some Examples-
2. Try with texts you brought

C. RAFT Question Model

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Audience** | **Format** | **Topic** |
| Experienced Water Drop | New Water Drops |  | Journey Through Water Cycle |
| Lungs | Brain |  | Why Quit Smoking |
| Seed | New Cells |  | My Parts and How They Function |
| Safety Goggles | Family |  | Safety in the Lab |

Try this on a topic/reading you teach. Blank form

|  |  |  |  |
| --- | --- | --- | --- |
| ROLE | AUDIENCE | FORMAT | TOPIC |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

D. Numbered Heads Together

Numbered Heads Together is a [cooperative learning](https://www.teachervision.com/pro-dev/cooperative-learning/48531.html) strategy that holds each student accountable for learning the material. Students are placed in groups and each person is given a number (from one to the maximum number in each group). The teacher poses a question and students "put their heads together" to figure out the answer. Alternatively, the students may write the questions as well. The teacher calls a specific number to respond as spokesperson for the group. By having students work together in a group, this strategy ensures that each member knows the answer to problems or questions asked by the teacher. Because no one knows which number will be called, all team members must be prepared.

1. Please use the following document provided and write
2. one text dependent question
3. one text extender question
4. one creative/analytic question

2. As I use your questions, you must arrive at a group answer and be sure that every member of the group is able to answer the question.

3. How might you use this with your students? Try on the text you have brought.

Part III: Dare to Disagree: Ted Talk Margaret Heffernan

<https://www.youtube.com/watch?v=PY_kd46RfVE>

What Were Some of the Important Questions You Heard?

Write Them Down

Be Prepared to Participate in A Final Word Discussion

Part IV: Assessment: Pop Quiz

Popping open a can of soda, Alan Rodas told his senior high school science class that they were about to learn more about one of their favorite beverages - soda pop. They would be given two unmarked samples of soda. Without tasting the pop, students were to decide which was the diet variety and which was the regular kind -based solely on the samples' physical and chemical properties.

Their task was to identify and evaluate promising laboratory techniques for distinguishing the regular soda from the same brand's diet variety. They were to devise a research plan, test the techniques that they had proposed to see which was most reliable scientifically, and apply the technique they had identified on unknown samples of soda. Their work would be done in small groups.

The "pop quiz" was designed to help Mr. Rodas and his class gauge students' progress along several important dimensions, including their capacity to:

• Understand scientific concepts and principles and apply them to real - world situations;

• Design an empirical test;

• Apply scientific laboratory procedures; and work effectively with peers.

Mr. Rodas asked students to get started by themselves. They wrote down at least three ways to distinguish between the two sodas, and explained why they chose those methods.

Then they joined small groups and brainstormed. Each group chose two tests to carry out and designed an experimental plan for these tests. Students chose a variety of techniques, including testing the samples' boiling point, freezing point, density, conductivity, and solubility. Some students suggested using the "sticky test" or urine glucose test strips to gauge sugar content. Some wanted to add yeast and Benedict's solution to test chemical reactions of the samples. Others suggested adding sulfuric acid to identify caramel. Students also proposed testing the samples' aroma, color, and amount of fizz.

To challenge his students, Mr. Rodas put our various pieces of equipment and materials that were not necessarily needed. He encouraged the class to use these materials in ways that were not thought of previously.

Once Mr. Rodas approved their plans, the groups carried out their experiments. Then groups prepared a report of their results and presented their findings orally to the class. Mr. Rodas filled out a form for each group gauging how well they met the objectives. Performance was rated as "excellent, "good," or "needing improvement." If a student's work was exceptional, he noted that

Each group also rated each member's performance on the following measures: group participation; staying on the topic; offering useful ideas; showing consideration to other group members; judging the extent to which each involved others; and ability to communicate. If the group could not agree on a rating, they could comment on the process.

When the ratings were complete, Mr. Rodas asked the students to finish the exercise by themselves. He told them to imagine that they were given two samples of liquids, one containing a mixture of two sugars (fructose and sucrose), the other containing only one of the sugars.

Students were asked to list all of the tests that had been hied on the soda samples that would also be useful in testing the two new samples. Then Mr. Rodas asked students to propose other tests.

Finally, students were asked to react to the experiment, stating what they liked and didn't like; how they felt about working in the group; why they would or would not like more group problem-solving activities; how they felt about using tasks to evaluate knowledge and skills; and what, if anything, they had learned.

Then Mr. Rodas opened up a case of soda and the class happily consumed its evidence.

Source: The National Center for Improving Science Education, 50.39.

Part V: Essential Questions

**Essential Questions in Science**

* What makes objects move the way they do?
* How are structure and function related in living things?
* Is aging a disease?
* Why and how do scientific theories change?
* How can we best measure what we cannot directly see?
* How do we decide what to believe about a scientific claim?

**Cross Discipline EQs:**

How do we prove something?

Why do we have rules/laws/principles?

Why is there more than one way to solve a problem?

Part VI: I**mpatient Problem Solving**

“Patient Problem Solving”: Dan Meyer <https://www.ted.com/talks/dan_meyer_math_curriculum_makeover>

1. As you watch the video, consider the way we usually ask students questions in Math.
2. What is the speaker’s critique of this process?
3. What does Impatient Problem Solving look like in your discipline (even if you don’t engage in it)?
4. How can you set up Patient Problem Solving for your Students?