Some Teaching Strategies for Involving All Students … so All Can Learn

- **To give all students an opportunity to talk about science, volunteers can…**
  - ***Use hand raising*:** In large group discussions, have students raise their hands and work to call on different students. You can say, "I have heard from a few people a lot; I want to hear from someone who has not spoken yet." Do not call only on the same student that raises their hand over and over again.
  - ***Practice wait time:*** Pause for 3 to 5 seconds (longer than you think!) after you ask a question before you call on anyone to speak. This allows for students to think and get the courage to raise their hand.
  - ***Allow many students to respond to a question:*** After you ask a question, say that you'll wait for at least 5 students to raise their hands before you call on anyone to speak. If applicable, ask several students to speak.
  - ***Assign which students from small groups will report to the large group**:* You can do this in many ways, for example the student who most recently had a birthday.
  - ***Encourage student voices**:* Encourage students to share their ideas and try to talk through student misconceptions instead of immediately correcting wrong answers. Make them feel safe in participating.
- **To give all students an opportunity to handle materials, volunteers can…**
  - ***Bring lots of materials:*** It's optimal to have enough materials for students to work in pairs; if you're bringing in only one specimen (for example, a brain), have enough gloves for everyone.
  - ***Plan to do a hands-on activity*:** Lectures and demonstrations don't involve all students in handling materials.
  - ***Work in small groups or stations:*** Divide students among volunteers and teacher. Working in small groups allows for more student participation and engagement.
  - ***Monitor student groups:*** Encourage students to share the materials and that no one student in particular handles the materials.
- **To give all students an opportunity to think for themselves, volunteers can…**
  - ***Again, practice wait time:*** Pause for 3 to 5 seconds (longer than you think!) after you ask a question so everyone has a chance to think about the question quietly to themselves.
  - ***Ask open-ended questions:*** Instead of asking, "How many chambers does the heart have?", ask students, "What do you know about the structure of the heart?"
  - ***Allow students time to write:*** An opportunity to jot down their ideas on paper helps many students rehearse what they may want to ask or share in a whole group discussion.
  - ***Use a Think-Pair-Share:*** An opportunity to first think quietly, then share their ideas with another student helps many students rehearse what they may want to ask or share in a whole group discussion.
- **To give all students an opportunity to do science for themselves, volunteers can…**
  - ***Keep your hands in your pockets:*** Tell students how to do things, don't physically do it for them.
  - ***Answer questions with questions:*** Often students know more than they think, so before answering their questions, probe what they know further with another question. For example, a student might ask, " What is blood for?" You could answer, "Well, what do you know about blood?" **See back of this handout titled *Questions are the Answer,* for more examples.**

- **Try not to plan too many activities. Students need TIME to become involved - to think and talk about science.**

Questions are the Answer

from *The Science Teacher*, January 1996 by John E. Penick, Linda W. Crow, Ronald J. Bonnstetter

Answer questions with questions: Often students know more than they think. So, before just answering their questions, probe what they know with additional questions. Below are some examples that may be helpful.

History: *We begin with history because these questions relate to the students' experience… students can almost always talk about what they have done...*
What did you do?
What happened?
What happened next?
What did you do first?
In what order did you…?
What procedure did you use?
What color/temperature/weight/size was it?
What made you think of doing that?

Relationships: *Seeking relationships and patterns is an essential process of science…*
How does this compare to…(other outcomes, procedures/experiments)?
If _____ happened, what happened to ___?
Where have you seen something like this before?
In talking to other students, who else got similar results?
What order does that usually follow?
What seems to be a common element in all your findings?
Where/When/How do you usually find these?

Application: *Applying knowledge is generally acknowledged to be a true test of understanding, as well as the surest way to truly know something…*
How could you use this?
What problems could this solve?
Where can we find examples of this in the real world?
If you wanted to do ____, how would this idea/knowledge/finding/experiment help?
What machine could you build that would do this?

Speculation: *Here students must go beyond the data and information given, abstracting to new and unusual situations…after a student makes an assertion, a teacher might ask a speculation question, such as…*
What if you…changed/eliminated/added/mixed/waited?
What would it take to prove that?
If you wanted to prevent that from happening, what would you do?
If that's true, then…
What might be inside that black box?

Explanation: *Communicating an idea, process, or theory to clarify both the nature of the phenomenon and how it occurs…*
How does that work?
What causes that to happen?
How would _____ cause ____?
How would you change your explanation if I changed this part of the apparatus?
How would it affect your explanation if I _____?
How does your explanation fit this other phenomenon?