A Message from Terri H. Mozingo, Chief Academic Officer

Science is a critically important part of all our lives. Through it, our world is transformed. We are very excited that this eighth version of our ongoing series “Tips for Teachers” focuses upon this critically vital area in our curriculum. As you will see in the rich highlights presented below, science instruction engages all learners in the process of inquiry and investigation. It also reinforces the power of experiential learning, immersing students into the analysis of their physical world. It is also a powerful context for reading and writing in the content areas.

What Does the Research Tell Us About Effective Science Instruction?

1. The Importance of Questioning: Great teaching and learning in science engages students in questioning, rather than mechanical memorization of discrete information.
2. Developing and Using Models: Scientific inquiry requires that students understand abstractions using concrete models and visual representations.
3. Planning and Carrying Out Investigations: Students in effective science classrooms engage in scientific investigations, not passive forms of teacher-directed instruction.
4. Analyzing and Interpreting Data: Great science classrooms integrate students’ study of scientific concepts using mathematics, computational thinking, and data analysis.
5. Constructing Explanations: As students construct and test hypotheses, they gather information through scientific inquiry and construct explanations about scientific phenomena.
6. Engaging in Arguments Using Supporting Evidence: Effective science instruction encourages students to formulate claims and arguments—and support them with a range of evidence.
7. Obtaining, Evaluating, and Communicating Information: Excellence in science instruction encourages students to use a range of sources—including their own observational skills—and evaluate the validity and reliability of the arguments presented by others.

Lessons from SAILS

The Alexandria Science Academy for Improving Learning in Science (SAILS) is a collaborative project between Alexandria City Public Schools (ACPS) and George Mason University (GMU) that started in the 2015-16 academic year.

This project is funded by a competitive Math Science Partnership (MSP) grant award from the VDOE. SAILS seeks to improve science teaching and learning in ACPS. The goal of Alexandria SAILS was to bring a coherent set of strategies designed to help schools to provide high-quality, inquiry-oriented science instruction in elementary classrooms (grades 3, 4, and 5).
Key SAILS Resources
All the session resources have been archived for easy access online:

https://sites.google.com/site/acpssails1516/

https://sites.google.com/site/acpssails201617/

“You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make.”

- Jane Goodall

For the last two school years Nancy Holincheck, Ph.D. and Mollianne Logerwell, Ph.D., have provided full-day Saturday sessions that targeted gap areas in science content in the grade 3-5 standards.

In a typical session, teachers explore a variety of engaging hands-on investigations that can be replicated in the classroom with a focus on the use of various scientific practices to better align classroom science with the work of real scientists. Teachers receive reference books and supplies needed to implement what they learned in their own classrooms.

SAILS Empowers Teachers to Improve Their Science Instruction!
An analysis of the teacher data gathered last year indicates a statistically significant gain in teachers’ efficacy score on the Science Teacher Efficacy Beliefs Instrument (STEBI) which measure efficacy beliefs and outcome expectancies. In other words, teachers felt more confident of their content knowledge and their ability to teach science as a result of participating in the SAILS sessions. In addition, teachers had higher expectations regarding their students’ science achievement. Participants also showed gains in content knowledge on key elementary science ideas and practices.

ACPS School Gardens
School gardens serve as unique outdoor educational environments which provide teachers an opportunity to cultivate their students’ learning by incorporating Virginia SOL-related lessons into their curriculum. These gardens allow students to literally dig in and experience hands-on learning, and they are especially valuable to those students who reside in housing with little to no green spaces. School gardens are a team effort between ACPS, the individual schools, and their parent groups, and the local community.

School gardens not only enhance science curriculum, but many other elements as well. When students plant flowers in color patterns, they are actually building a foundation to learn the concept of functions in math. Students can make observations about a tulip bulb, plant it, measure and chart its growth in the spring, and then examine its parts once grown. School gardens serve as mini weather stations by allowing students to predict, then observe and record temperatures and rainfall by using their garden’s temperature gauge and rain collector. By growing wheat and cotton, students are able to learn about the history of cash crops and how such crops are utilized today.

School gardens require a tremendous amount of community collaboration, so we encourage you to get involved with your school garden. You can contact your school’s children’s garden liaison, PTA, or the ACPS Garden Lady.
ACES Writing Strategy

In science, students are often asked to write conclusions based on data without a model for how to accomplish this task. The ACES writing strategy provides a simple framework for students to accomplish this.

It begins with a teacher question or “problem” that the student is trying to answer in the lab. For example, “What is the effect of temperature on reaction rate?” The student can often ANSWER this question, but does not include evidence for their answer. This is where the ACES strategy can be helpful. It then prompts the student to CITE up to three pieces of evidence from the data to support this answer.

Students must then EXPLAIN how the data supports the ANSWER. This is where teachers can truly see their students thinking. It also leads students to make higher-level connections.

Finally, students SUMMARIZE in their own words to show what they have learned.

\[A = \text{answer} \]
\[C = \text{cite} \]
\[E = \text{explain} \]
\[S = \text{summarize} \]

Refer to the margin for links to online resources related to this strategy.

Preparing Your Students for the Total Solar Eclipse

August 21, 2017

Did you know that you and your students have a rare opportunity to view a solar eclipse this summer? Alexandrians will not see a total eclipse, but we should be able to see a 90% eclipse between 1:17 – 4:01 PM with the maximum percentage of the sun blocked by the moon at 2:42 PM.

Find more teaching and learning resources online related to the Total Solar Eclipse on the NASA website https://eclipse2017.nasa.gov/
A REFLECTIVE QUESTIONNAIRE

Teachers and administrators can use the following self-reflection questionnaire to assess the extent to which research-based best instructional practices are a regular part of science instruction in their schools at all levels. Please let us know how we can support you in this work.

To what degree do the lessons in my unit:

1. Contain science content that is **significant and worthwhile**?
2. Contain science content appropriate for the **developmental levels** of my students?
3. **Align with the Standards of Learning** identified in the ACPS curriculum?
4. Engage students intellectually with important ideas, relevant to the unit’s **essential questions**?
5. Portray science as a **dynamic body of knowledge** continually enriched by conjecture, investigation, analysis, and/or evidence?
6. Allow for developmentally appropriate **sense-making** of the science content?
7. **Align assessments** with the significant Standards of Learning for that unit?
8. Incorporate formative assessment, providing students with data-based coaching and **on-the-spot feedback** using a variety of tasks?
9. Adjust instruction using **formative assessment** feedback?
10. Allow students multiple ways to **demonstrate their knowledge**, skills mastery, and understanding?
11. **Utilize rubrics** and other forms of scoring criteria to help students understand the criteria for quality work?
12. Culminate in **meaningful summative assessment** tasks that allow students to display and confirm their understanding of key concepts, skills, and big ideas?

Adapted from “Designing Effective Science Instruction”
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