

*Springboro Community Schools
1685 S. Main Street
Springboro, OH 45066
937.748.3960*

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By Kerri Matheny
District Science and Math Coordinator

Addressing Scientific Literacy

In a recent study, new Harvard graduates were asked to explain the cause of the seasons. Of the 23 graduates interviewed, 21 answered the question incorrectly. Even more alarming, one graduate asked had taken a class at Harvard called “Physics of Planetary Motion”. The study, focusing on the improvement of scientific literacy by addressing science misconceptions, found that once students develop misconceptions they often retain those misconceptions throughout their education. This was found to be especially true when students are “told about” science and do not “discover” science. Research also shows that misconceptions are addressed when students of all ages and ability levels experience inquiry-based instruction. Inquiry-based instruction includes discovery activities and lab experiences as a key component of the classroom. In fact, the Ohio Department of Education (ODE) deemed inquiry learning so important to science literacy that Senate Bill 311, Ohio’s CORE Curriculum, states all science course must be inquiry based by 2014. ODE is currently working with the Science Education Council of Ohio (SECO) to create professional development in inquiry-based instruction for science teachers throughout the state.

Recognizing that a quality science education must start early, Springboro Community City Schools has improved the elementary science program by adopting an excellent resource, the Macmillan/McGraw-Hill Science: A Closer Look textbook series and accompanying science equipment kits. Inquiry-based activities are a part of every lesson so students can “do” science and investigate science misconceptions. Literacy connections, in the form of vocabulary development, writing practice, and comprehension strategies, support the science content. It is too soon to determine the effects of the program, but Springboro is confident that students are experiencing and learning more science, addressing misconceptions, and improving their scientific literacy.

Springboro teachers address science misconceptions by allowing students to “test out” their ideas and analyze data. While the term “misconception” has a negative connotation, these ideas are simply a child’s way to organize their observations and understand the world. Misconceptions can form in a variety of ways. In some instances, students may understand two concepts correctly, but combine them, creating a misconception. Sometimes, what seems like a logical conclusion is drawn from limited observations such as by collecting a small amount of data or looking at only one diagram. Modern

language is often in contrast with scientific language and contributes to misconceptions. Saying, “It’s just a theory”, or using the words weathering and erosion interchangeably are examples of modern language contributing to misconceptions. As students build knowledge based on current understanding, misconceptions can have a cumulative effect. Teachers often assess what students are thinking by having students write about science or through class discussions. For example, asking, “How do plants get their food?” may reveal the misconception that plants get nutrition from the soil. A few common science misconceptions are:

1. Seasons occur because the Earth is closer to the sun in the summer and further from it in the winter.
2. The moon is visible only at night and not during the day.
3. Meteors are “Falling stars”.
4. All stars are the same distance from the Earth.
5. Dinosaurs and humans lived at the same time.
6. A light bulb produces light of only one color.
7. Batteries have electricity inside them.
8. An object at rest has no energy.
9. Velocity is another word for speed.
10. Continents do not move.
11. All radioactivity is man-made.
12. All magnets are made of iron.
13. Air and oxygen mean the same thing.
14. You can only measure to the smallest unit shown on the measuring device.
15. You can see and hear a distant event at the same moment.
16. The sun will never burn out.
17. Rain water should have a neutral pH.
18. Cellular respiration is the same as breathing.
19. Plants absorb food from the soil.
20. Plants produce oxygen for our benefit.
21. Carnivores can exist in a plant free world.
22. Individuals can adapt and evolve.
23. Blood is blue inside the body and turns red when exposed to air.
24. Whales and dolphins are fish.
25. Digestion is the process that changes food to energy.

Throughout the year, ask your child about the scientific learning occurring at school. Let your child’s teacher know if you discover that your child has a misconception. By addressing misconceptions, scientific literacy is improved.