Parent & Community Network News

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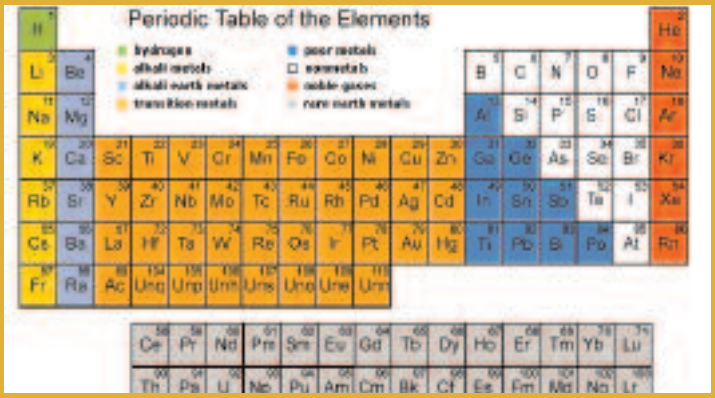
Every great advance in science has issued from a new audacity of imagination.
~ John Dewey



NATIONAL ASSOCIATION FOR Gifted Children

Focus on STEM

Editor's Notes

In the last few years, there has been quite a national discussion about the need to beef up the teaching of science, technology, engineering and mathematics, also called STEM.. The late 1950's brought a similar push. This issue focuses on capturing opportunities for scientific inquiry. (Next month we focus on the arts.)

I believe that wondering about how things work and why things are they way they are and about all the possibilities are so much a part of being a child. Giving children alone time for thinking and encouraging "pondering" will lead to new and exciting possibilities.

All too often schools expect single correct answers to factual questions. I wish there were more problem based projects in our schools so that children could learn and figure out new ways of solving challenges. Creativity, imagination and perseverance will be what brings resolution to things like oil spills, job loss and cancer.

Of course all this requires a great foundation in mathematics and the sciences. Let's continue to encourage high quality teaching and learning of the basics and more advanced concepts and skills by highly trained teachers who really understand the discipline they are teaching. Let's ensure the activities are relevant and meaningful. Rote memorization alone will not bring innovation.

A few years ago I was visiting a gifted school in Beijing and was amazed as I watched 10 year old children creating and applying trigonometry to everyday situations. When the application is there, real learning takes place. It can happen in the USA also.

Table of Contents

Capturing the Moment

(Editor's note: This article was sent by a reader that inspired me to create a column for short articles on experiences you have had with your children. Please tell us about when you were Capturing the Moment.)

Recently, my son and I attended a workshop on watersheds and how to build a rain barrel. My son has been interested in the environment since he was quite young. As many kids like him, he is quite skilled at multitasking. Although he took in most of the information about how to build a rain barrel, he spent most of the time watching the birds which were flying around right outside the open door. As we left the workshop, he stopped to stalk a swallow perched on a bluebird box, so that he could get some great photos of it. This led to a discussion with a couple other workshop attendees, who also happened to be serious birders. They admired my son's photography skills with the swallow. As we talked, they realized that he is quite the amateur birder and we ended up birding with them for about an hour.

During that hour, my son learned more about birds than he learned about science topics all year in school. He also had the opportunity to share his enthusiasm for a subject and his knowledge with people who were just as enthused as he was. This is not something which routinely happens at school, where his friends complain of his "obsession" with birds and his teachers ask him to show his math work on his paper, instead of his intricate drawings of everything ornithological. He enthusiastically shared his knowledge of birds and received some wonderful mentoring in that hour which passed too quickly. Equally as important, his love of birds had the right audience and was well-received. He was, in educational terms, spending time with "intellectual peers."

Opportunities are where you find them. Parents can do a lot towards fostering these opportunities, which can be more valuable learning experiences than the most highly- touted summer camps for gifted kids. A walk in the woods becomes a lesson about insect taxonomy. A hike in the mountains becomes a lesson in angle of ascent or how to read topographical maps. A trip to learn how to build a rain barrel becomes moments of sheer joy as my child is enraptured by the diving, spinning nighthawks grabbing insects on the wing, right above his head on a clear spring evening; surrounded by people who just like him are not even bothering to wave the insects away from their faces as they gaze skyward and smile.

Gigi Gerben, MS-Ed. is an educator and writer who spends time gleefully grabbing the opportunities which abound in Western PA.

Websites to Explore

Here are a couple websites that you might want to explore while looking for all ideas and help with Science, Technology, Engineering and Math (STEM)

~For fun toy ideas to make that exhibit science concepts:
http://sciencetoymaker.org/

~For a collection of YouTube videos explaining math and science concepts (and more)
http://www.khanacademy.org/

Supporting the Spirit of Scientific Inquiry

by Jann H. Leppien
Originally printed in: PARENTING FOR HIGH POTENTIAL/SEPTEMBER 1999

Where does the white go when the snow melts?
I wonder if lightening is caused by clouds crashing into each other?
Why can't I see the moon in the daytime?

Children are natural scientists, instinctively eager to investigate the world around them. Through inquiry and experimentation, children develop a conceptual understanding of important scientific ideas. As children's first teachers, parents can help instill a questioning disposition and a sense of joy in the inquiry process.

Attitudes for Scientific Inquiry

Science is a way of understanding the world and a pattern of thinking that begins to develop in the very earliest years of a child's life, making parental involvement crucial in a child's science education. By showing enthusiasm for and encouraging children's questions, families play a critical role in nurturing scientific thinkers and inquisitive explorers.

Instill Positive Dispositions

Parental beliefs about science strongly influence children's attitudes toward science. When you don't have a strong background in science, it is more important to convey a positive outlook through statements such as, "I'm not sure I understand this scientific idea, but let's see if we can find an

answer by experimenting together." Avoid saying, "I never really liked science in school. You'll have to ask your teacher." This message conveys that scientific concepts are undesirable or unattainable. What's far more important than knowing specific scientific content is having a positive attitude about science and the nature of questioning. Every day is filled with opportunities to learn science without expensive science equipment or a strong knowledge of scientific content. You can introduce your children to the natural world around them by watching the moon change shape over the course of a month, observing the return of various types of birds during the spring, or discovering how animals learn to hide from their enemies. Learning how to observe objects carefully is an important first step leading to scientific explanations. Creating excitement in this learning process is far more important than knowing the right answers to specific science questions.

Use Open-ended Questioning

While it is tempting to provide pat answers to children's questions, parents need to allow their children to develop their own perspectives about the physical world. By using open-ended dialogue, responding to questions with questions, and encouraging your children to design experiments, you can help them gain confidence in their thinking and develop the skills and interest in experimental design. Though their answers may not match current scientific interpretations, your children will learn how scientists seek answers to their inquires. They can "test out" ideas through experimentation and then revise these thoughts as new evidence presents itself. During a recent discussion about box elder bugs crawling on my garage door, I was intrigued by how fluently a six-year-old neighbor of mine worked through the scientific process as I asked her a number of open ended questions.

Wendy: "I wonder why you have so many box elder bugs on your garage door?"
Jann: "I don't know. Do you?"
Wendy: "I think it's because of the color of your garage door."
Jann: "Well, I wish I could encourage them to fly somewhere else in the neighborhood. Do you have any ideas?"
Wendy: "Yes, but I think that we need some type of container and food to get them away from your door. I know that when I need my dog to follow me, I can get him to move if I encourage him with food. Maybe we could try this with the box elder bugs."
Jann: "What would you like me to get for you so we could try out your idea?"
Wendy: "If you could get a jar lid and some corn syrup, I think that we could get the box elder bugs to leave the garage door and follow us to another spot on the driveway."

After setting up the jar and corn syrup, Wendy and I sat together in the middle of the sidewalk and waited for the box elder bugs to follow us. After 15 minutes, Wendy suggested that we try vinegar instead of the corn syrup. When the vinegar failed to move the bugs toward us, Wendy remarked in a loud voice, "Maybe if we use dog food, they will follow us like my dog does!" By exploring her ideas and suggesting experiments (with only a little prodding from me) that may lead us to some course of action, Wendy has gained a great deal of knowledge about how the scientific process works and more importantly, how her questions are the basis for constructing her own knowledge. She may not have the solution to my box elder bug invasion, but she has gained confidence in her own thinking abilities which will be of greater importance as she grows older.

Supporting Individual Interests

Different children have different interests and require individual guidance as they explore their various interests in science. If your child loves dinosaurs, let him or her explore dinosaurs with great zest and energy. It is important to follow your child's lead when selecting activities, as your interests may not coincide with your child's. When children select their own interests and guide their own investigations, they will learn more and have a better time exploring a particular topic in depth. Listen carefully to their questions and alert yourself to the topics in which a genuine interest is starting to develop.

Tolerating Disarray

We have all watched children tirelessly play in a puddle of water after a rainfall, catch raindrops in their mouths, chase the waves during a day at the beach, and come back a mess. In search of answers, we use science to both investigate and to test our hunches about certain scientific events, and these investigations may be messy. It is important for parents to recognize the difference between clutter that comes from enthusiastic activity and the piles that result from a failure to clean a particular area. Supporting scientific inquiry requires some level of acceptance of the disarray caused by experiments in progress. In supporting your child's desire to answer his or her questions through experimentation, you might consider finding a location that is suitable for the piles which could result from a child's scientific exploration.

Processes for Scientific Inquiry

In supporting your child's interest in scientific inquiry and investigation, it is helpful to become knowledgeable about the skills used by scientists as they search for new discoveries. Children can apply

Dates to Remember:

Webinars on Wednesdays (WOW)

June 23

Summer Strategies: What Web Resources Work for High Ability-Learners

Brian Housand

June 30

Connecting for High Potential: Parents and Teachers Partnering for Successful Outcomes

Keri Guilbault

November 11-14
NAGC Convention
Atlanta, GA

Parent Day is Saturday, November 13

Register at www.nagc.org

Go down deep enough into anything and you will find mathematics.
~Dean Schlicter

these same processes as they begin to design their own experiments.

Observing

All scientific understanding and discovery is based in observation. Ultimately, it is an observation that leads to an investigation or determines a course of action in setting up an experiment. In the beginning stages, scientists observe the world around them through the five senses. Make it a habit to give your children occasions to express themselves by talking about what they see, hear, smell, taste, and feel. As they examine rocks, ask them to talk about color, size, texture, and weight. As they listen to music, help them describe the way in which musical instruments sound. As they observe the changes in seasons, invite them to express their observations in the changes of temperature, leaf coloration, and the difference in the length of daylight hours. Your child can keep a record of observations in journals or notebooks. Keeping records helps a child notice patters. For example, he or she might begin to notice that as the daylight hours have decreased so has the physical activity among his or her family members.

Inferring

Children often state inferences as they try to explain or interpret one or more of their observations. They observe the return of a greater number of Canada geese on the river and may say, "Spring will arrive soon." Sometimes the inferences will be based on inaccurate perceptions rather than observations. Helping your children explain their inference and asking them to consider other factors that may influence a certain perception can assist them in making accurate statements.

Classifying

It is common for children to group objects or events according to their characteristics. You can help your child develop this skill more fully by asking him or her to recognize similarities and differences between objects and then classify them according to some group name. For example, you can use a collection of rocks or geometric shapes to help your child make detailed observations and then sort them into different groups of shape, size, and other identifying properties.

Measuring

Science experiences provide many opportunities to explore numbers and their applications. You can ask your child to describe and compare the weights of objects, measure how much time has elapsed between observations, take the temperature of different liquids, and measure the distance between trees in a park. Exploring observations mathematically prepares your child for collecting data which may reveal a relationship between two or more events and for making more accurate inferences and predictions.

Predicting

Repeated observations of conditions or events often reveal patterns, allowing scientists to make inferences and predict future conditions or events. Predictions are based on observations over time, measurements, and resulting inferences about relationships between observed conditions or events. Children are not strangers to the notion of predictable events. Helping your child make numerous and repeated observations over time assists him or her in stating accurate inferences and noticing patterns which lead to future predictions. For example, a child can observe and record the feeding.habits, bathing

Lo! Men have become the tools of their tools.

~Henry David Thoreau

habits, social interactions, or any other part of a bird's life that occurs at or near a bird feeder. Noting these behaviors over time will allow your child to make various predictions about specific birds

Recording and Communicating

Learning how to keep a record of observations is an important part of the scientific inquiry. It is important to help your child record what didn't work as well as what did work during an experiment. In order to record and communicate findings, children can write or draw pictures of what they see, show data on charts, graphs, and other visual demonstrations, and even take photographs of scientific observations over time.

Formulating Hypotheses

Before experimentation begins, your child should first examine the information already available about the topic being investigated. This information, coupled with observations, is the basis for making an educated guess about the cause of a problem or about what new information may be revealed through further study. Such an educated guess or idea is called a hypothesis. By making a hypothesis, a child can then consider how an experiment will be set up to test this idea.

Identifying and Testing Variables

Often in an experiment, scientists are trying to find out which conditions or factors affect the outcome of an experiment. For example, when trying to investigate how far a marble will travel across the floor after rolling down a ramp raised to varying heights, the height of the ramp is one of the variables which may influence the outcome of the event, but the surface of the floor, the conditions of the track, and the size of the marble may also be variables which may or may not affect a particular outcome. These variables are what scientists manipulate to observe their effects on the distance a marble will travel on an outcome variable. It is important to help your child manipulate or change one variable at a time to see its effect on the outcome. (These process skills are more complex and advanced and should be viewed developmentally as you work with your child.)

Inexpensive Ways to Nurture Inquiry

You can support your child's interest in science by using resources around you. Nature supplies endless opportunities for making observations, stating predictions, and testing ideas or scientific hunches. Below are several ways to encourage and support your child's interest in science.

- Challenge your child to perform simple, unstructured experiments based on his or her interests and observations. Avoid the prepackaged experiments found in books. Over-reliance on these books does not promote problem-solving, creative-, or critical-thinking skills in your child.
- Locate members in your community that apply science in their careers. Some of them may be willing to mentor your child when he or she is interested in a particular science topic. Encourage your child to ask questions about the type of work that these people perform and the type of training that is required for their career choices.
- Encourage your child to take gadgets apart! Old toys, clocks, and household appliances are great lessons in scientific design.
- Explore museums as you travel on family vacations. Science museums are excellent places for children and adults to play with scientific ideas and make new discoveries.
- Locate biographies of scientists to share with your child. These biographies may instill a new appreciation for the type of dispositions that are needed by scientists.
- Use hypothetical questions beginning with "What if...?" "What have you noticed about...? "How would you design a fair test to...?"
- Assist your child in setting up a rock garden, bird feeder, or other outdoor projects in your backyard that your child can observe over time.
- Encourage your child to submit articles to some of the numerous publications that support student writing on scientific topics. The National Science Teachers Association (NSTA) publishes Dragonfly, a magazine for young explorers and encourages students to submit their investigations for publication.

By giving children encouragement and opportunities to act on their scientific hunches and by providing them with inexpensive materials that support the development of scientific concepts and processes, you can nurture the spirit of scientific inquiry in your children—even if you aren't a scientist yourself.

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