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He did not speak until he was three, and when he could talk, choosing words was difficult. His frequent angry outbursts occasionally turned violent. As you might expect,

he did poorly in school and his teachers predicted that he would amount to "nothing good." But when taught how to make buildings from playing cards, he spent countless hours at it, constructing some structures 14 stories high. He also enjoyed making jigsaw puzzles and constructing buildings from prefabricated blocks. By the age of 10, his skill in building elaborate structures was recognized, and at age 15 he was put into a special school that stressed learning through observation and doing. These early experiences, combined with his unique intellectual gifts, helped this young man--Albert Einstein--to become one of the most creative scientists ever to expand our knowledge of the world.

THE MEANING OF SCIENCE

You do not need to be an Einstein to value and use science. Most of us grew up believing that science is an organized collection of facts. However, science is better defined as a way of observing and thinking about the world, and communicating these thoughts to others. Experience and research show that young children are excited about science when they are given the chance to "do" science. To give your children a firm foundation in science they should be encouraged to think about and interact with the world around them. Concrete experiences that require the use of children's senses, such as planting and watching a seed germinate, provide a strong framework for abstract thinking later in life.

Many skills that help your children succeed in science also help in everyday life. Observing, inferring, measuring, communicating, classifying, predicting, controlling variables, interpreting data, and developing models are important science process skills recently identified by the National Science Teachers Association. These skills are not just essential for careers in science, but they are important for almost any career, as well as in daily life.

WHEN SHOULD SCIENCE INSTRUCTION BEGIN?

As a parent, you are your children's first and most influential teacher. The best time to introduce children to science is when they are curious about the world around them. From their first moments of consciousness, children are on a passionate quest to understand their world. Placing interesting mobiles over your child's crib helps focus the infant's attention, spurring the development of observation skills. As children mature, they naturally become more curious about their environment and begin to interact with their surroundings. From simply touching things with their hands, feet, or mouth, they progress to moving objects, twirling spinners, and dropping food from the high chair to enjoy the effects these actions produce.

Science in the early years should be an extension of these natural behaviors. Rich sensory experiences (seeing, hearing, tasting, touching, and smelling) can help children become more observant and curious. Exploring the characteristics of objects and living things can help them learn how to classify or group things based on their

characteristics. By playfully interacting with their environment, children understand how they are distinct from the world around them and how they can influence aspects of it. Science begins for children when they discover that they can learn about the world through their own actions, such as blowing soap bubbles, adding a block that causes a structure to collapse, or refracting light through a prism. A child best learns to swim by getting into the water; likewise, a child best learns science by doing science. Hands-on science experiences, together with conversations about what is occurring, are the best method for developing children's science process skills. These experiences go beyond improving science skills to improving reading skills, language skills, creativity, and attitudes toward science. Fortunately, these hands-on science experiences are ones that most children enjoy.

SCIENCE AROUND THE HOME AND COMMUNITY

There are many activities you can do with your children to help them develop skills related to science. Opportunities for positive science experiences can be found in kitchens, yards, parks, science museums, beaches, nature centers, and even toy boxes. While many aspects of science can be very intricate and intellectually demanding, it is important to remember that often the simplest experiences may produce the most profound learning.
Some general guidelines can help you do science with your children:

1. Introduce your children to stimulating environments. Oceans, swamps, parks, airports, and even kitchens, bathrooms, and backyards offer chances for observing and discussing science. Provide your children with situations that encourage playful exploration, a natural way for children to learn. Toys can be an important part of a stimulating environment. A child's intellectual and social development is not related to the number of toys or materials present, but to the kind of toys and materials. Children develop better skills if their toys are varied and educational. The more things a child can do with a toy, the more likely it is to be educational. Children can engage in many creative, constructive, and thought-provoking activities with toy building materials, for example.

2. Become interested in your children's science interests. Identify aspects of science that your children enjoy. Fuel these fires. Talk to your children about their science interests and encourage their efforts. If they are intrigued by dinosaurs, read dinosaur books, discuss dinosaurs, construct dinosaur models, and visit museums to see dinosaur fossils and models. Your understanding of your children's interests and

abilities will help you personalize their learning experiences.

3. Seize the teachable moments. Your child sees a beautiful tulip flower in the spring and asks about it. Use that opportunity to discuss flowers and bulbs. You can follow up by planting bulbs or flower seeds in the garden or in the house and watching them grow. The home environment is familiar to your children and fosters teachable moments that classroom teachers can only dream about; you can use these teachable moments to help your children become fascinated with science.

4. Provide hands-on experiences. Give children the chance to "do" science. Use the aforementioned suggestions as a starting point for further hands-on exploration of a scientific concept. Not only are hands-on experiences a great way to learn, but they are also a great way to get children excited about science. The resource list at the end of this digest contains many ideas for intriguing science activities. The best way to tell if an activity is appropriate for a child is to see if the child is interested while doing it. Activities should challenge, but not overly frustrate. If your child does not seem interested in doing a particular activity, suggest another one, or try it again at another time. Keep children's natural yearning for learning burning by not forcing them to do something they are not interested in doing, but by engaging them in motivating activities.

5. Share your science interests. If you have a science-related job or hobby, such as keeping a fish tank, repairing cars, or feeding birds, share the excitement. Nothing is as contagious as honest enthusiasm. Do activities together.

6. Bridge from the media. Movies, television specials, magazines, newspapers, books, and computer programs frequently present science-related topics (see resource list). Talk with your children about the science they encounter: What interested them? What did they learn? Older students may enjoy discussing whether the science presented in science fiction stories was real or fictional. For example, could a space traveler hear the whoosh of a space craft as it passed by in space? Answer: In outer space there is a vacuum. Since sound waves cannot travel in a vacuum, space travelers would never hear the sound of a space craft as it passed by them.

7. Set aside time for discussion. One of the key components of all the previous guidelines is discussion--a powerful tool for making children think and refocus their ideas. Doing one activity with discussion--either before, during, or after the experience--is better than doing four activities with no discussion. In fact, a powerful predictor for determining whether a child will attend college is whether or not the family eats dinner together in a setting that promotes discussion. Encourage your children to talk at dinner, on outings, and during activities. Through the effort to communicate, children are forced to construct thoughts, form concepts, and examine interrelationships among ideas. The measure of a good discussion is not how much an adult explains to a child, but how much the child is induced to think.

SCIENCE CONNECTIONS: HOME AND SCHOOL

Research on families and student learning has shown that students at all grade levels do better work in school, feel better about themselves as learners, set higher goals, and dream bigger dreams when their parents are knowledgeable, supportive, encouraging, and involved with their education. Parent involvement in education can take a variety of forms, including volunteering to help in the school, doing a presentation for a class, helping chaperone field trips, and supplying materials. The most important type of involvement, however, is encouraging, monitoring, and helping your children with their schoolwork. When parents and schools work together, children grow in an environment of consistent expectations and shared purpose, where children become better students, and parents become better teachers.

CONCLUSION

Helping your children acquire skills for understanding the world will enhance their success in science. Being excited about your children's science interests and schoolwork can promote further growth and quests for knowledge. Exposing children to your science-related interests, providing hands-on opportunities for building and exploring, and using experiences as a springboard for discussion are powerful methods for helping children develop process skills and enthusiasm for science. The skills your children develop will be important no matter what careers they pursue. The shared science experiences in which you and your children participate will create wonderful memories to last a lifetime.

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Reading, Computer, Video, and TV Resources in Science

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Club Kidsoft is a magazine and CD-ROM that features a buyer's guide for major software publishers, plus demonstrations of software. $9.95 for first four issues. 1-800-354-6150.

CRO is a television cartoon series featuring simple science ideas woven into clever

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NASA Materials

NASA materials are free and available to parents from (1) NASA Teacher Resource Center; Mail Stop 8-1; NASA Lewis Research Center; 2100 Brookpark Road; Cleveland, OH 44135; (2) NASA Teacher Resource Laboratory; Mail Code 130-3; NASA Goddard Space Flight Center; Greenbelt, MD 20771; or (3) your nearest regional NASA Teacher Resource Center.

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