Contents

Introduction

Animals

The Human Body

The Earth

The Four Elements Water, Air, Fire, Earth

Science Concepts

To the Teacher

What Makes Glow-worms Glow? is a science book written especially for the early primary years. All children are individuals, and this is especially true of the five- to seven-year-old! Their world is getting bigger every day; they welcome adventure. A year ago they might have avoided new people and unfamiliar zones, now they feel more confident with their social skills and are ready to charge into unexplored territory. No longer threatening, they view strangers with curiosity and see them as an opportunity to learn new things. Whenever possible, reinforce learning with appropriate guest speakers and field trips. As you work through the activities in this book, no matter what scientific experiment you present, youngsters this age will welcome the learning with dash and vigour.

Instead of calling the activities in this book experiments, I have chosen to use the term *experiences*. Each scientific experience is a developmentally appropriate approach to guide youngsters to an understanding of basic science concepts, and to teach them how to hypothesise through open discussions and learn through self-discovery. The activities are called *experiences* instead of experiments, because an experiment is something done quickly and soon forgotten. Experiences, on the other hand, are accomplished with all five senses. Experiences are the extraordinary events we treasure for a lifetime – lessons etched in our minds forever. There is a Chinese proverb that goes something like this:

*I **hear** and I forget,*

*I **see** and I remember,*

*I **do** and I understand.*

So in the spirit of true learning, each scientific experience in this book is divided into three categories:

Hear – introduce concept by asking a question and having an open-ended discussion.

See – teach concept by explaining facts and demonstrating a scientific experiment.

Do – reinforce concept by providing an opportunity for students to learn through self-discovery.

Hear

The **Hear** section of each lesson launches the science experience by asking a question. These riddle-type questions are a way of opening discussion and motivating children to think about and share ideas. Ask the question of the lesson and allow plenty of time for the students to share possible answers. This part of each lesson gives the children a chance to use their imaginations and explore a wide range of possibilities. Remember, when we listen to a person it sends a clear message about our interest and validates the speaker's worth. No matter what answers are given – no matter how far-fetched – record each one on the blackboard and praise students for creative thinking. Celebrate and encourage their wonder! Do not say that one answer is correct while others are wrong. Instead, just as scientists hypothesise, explore all the possibilities. Learning the process of determining a wide variety of possibilities is as important as actually grasping the scientific fact. In the second and third parts of each lesson (*See* and *Do*), youngsters will be introduced to specific scientific principles and perhaps through their play they will learn the answer to the initial questions. But whether they understand and can verbalise the answers is not important. The question and discussion stage of each lesson is simply a time to board a spaceship to begin a great scientific journey.

See

See activities will give you, the teacher, an opportunity to present basic scientific facts and demonstrate scientific principles. Scientific facts are brief and simple. Sometimes, several concepts are presented. You can decide how much to present to the students in one session. Scientific terminology such as: evaporation, radius, luminous, larvae, camouflage etc., are placed in parentheses. This will give you the opportunity to use the scientific terms or leave them out of the lesson, depending on the group of children you are teaching. The science experiment demonstrations are fun and only require easy-to-obtain materials. Since most early primary children are motivated to learn new things, they will watch with interest the varied scientific demonstrations. Their curiosity about the world will contribute to their active learning. Take your time and allow questions and discussion before, during and after each demonstration. Record any questions that the experiment triggers for your students. Encourage everyone to ask questions. Wonder is contagious. Through your own curiosity and engagement, children will model the awesomeness of it all. Do not forget, you are the captain of each scientific starship adventure.

Do

Because the students will be highly motivated to do the experiments, it is very important to have all the materials ready in advance. The **Do** activities will offer hands-on time, open-ended adventures, and playful investigations. Do not be surprised if the highly motivating projects sometimes get out of hand. Children this age often get overexcited, silly and giggly at times, and so safety will be of primary concern when working with your group. Over-zealous learners need close supervision. The key to success will be the special planning done in advance so the demonstrations and experiments 'go off' without a hitch.

Primary age children are easily stifled by adult agendas. So, go slowly. Be flexible. Allow plenty of time for the children to become immersed in investigations. Do not interrupt them or get in the way of their learning. You may count on your students' enthusiasm to spur them into deeper and more complex concepts than you ever set out to teach. They may become bored quickly, so if you see that you are losing the interest of your students because a discussion or experience is taking too long, present small bits of information on separate occasions. Bite-sized pieces may make the learning more enjoyable. Remember, children this age need and respect boundaries and limits which they cannot set for themselves. When leaving children to work in small groups, make sure they know exactly what is expected of them.

After the children have completed the activity, allow time for groups or pairs to demonstrate, talk about, and share what they did and learned. Special enrichment activities: 'A Closer Look' (videos to view), 'Share a Story' (appropriate books with additional information), 'Take It Home' (riddles to share with family members), and 'Further Exploration' (special enrichment ideas) are also included where applicable.

While using this book, remember, there is no need to arrive at scientific conclusions. The exploration journey and discoveries along the way are far more important than reaching a final destination. If the children are interested and want to take experiences one step further, see the next page for tips on developing science process skills.

Take It One Step Further

When I was a first year teacher, I met a wise, old man who told me, 'All children will learn, if the grown-ups will just get out of their way.' That ruffled my feathers – being a brand-new teacher, I was ready to test my wings. I just knew that it was my job to teach the fledglings to fly, lead the flock, show them how to soar. But over the years in my work as a parent, teacher, and writer of educational materials, I have learned to honour those wise words: 'get out of their way'. Self-discovery leads the way to all meaningful knowledge. After using each science experience in this book (asking the question, introducing the hypothesis, demonstrating the principle, and providing a follow-up experience) I urge you to allow children time to talk about what they have learned, to ask new questions, and to explore other scientific principles that evolve during the lesson. A good way to provide further exploration is with Science Centres where your students can develop their science process skills.

Observation Centre

To foster closer **observation**, set up an area where students can get up-close experiences. An Observation Centre should include: magnifying glasses, plastic mirrors, periscopes, telescope, insect box magnifiers and microscope. For example: page 49 offers ideas for creating a permanent 'Four Elements Discovery Centre' for observation of water, air, fire (solar energy) and earth.

Comparison Centre

To encourage **comparing**, set up a Comparison Centre. Include a balance scale and objects to compare weights: pencils, nails, coins, paper clips, crayons, pebbles, seashells, gemstones, leaves etc. Have students use the balance scales to see which objects have more mass, which are equal, and which have less. Include paper and pencils for drawing pictures showing how objects compare, differ, and rank.

Classifying Centre

To help children learn how to **classify** information, introduce vocabulary for attributes: colour, size, texture, shape, scope, volume, and quantity. For example: after completing the activity 'What horse is small enough to fit in your pocket?' on page 17, you might have pictures of animals and have children classify by the ones small enough to put in their pockets or too big to fit into a house etc.

Measuring Centre

To encourage children to **measure**, provide counters, rulers, measuring cups and spoons, bathroom scales, strings of different lengths, thermometers, an egg timer, tubs of water, and a sandbox. For example: when studying the human body, have the children measure hands, feet, arms, legs, etc. Graph information on individual charts. It might be that those who are the tallest do not have the longest feet. Learning to measure is easy when it is personal data.

Communication Centre

To encourage children to **communicate** what they have learned, have a special place to come together to reflect on what has been discovered and processed. Reviewing, discussing, and concluding will increase the vocabulary they need to process information. A Communication Centre should include paper and crayons for drawing pictures after each experience, tape recorder for recording data, notepads for tally marks, and other materials for displaying the results.

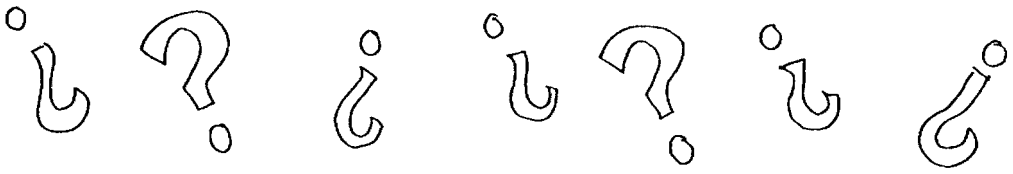
In closing, I just want to remind you of some words of wisdom: *All children will learn, if the grown-ups will just get out of their way.*

What Makes Glow-worms Glow?

Hear

Ask: What makes glow-worms glow?

Share: Discuss all the possibilities and list each one on the blackboard. Do not indicate a correct or incorrect hypothesis. Accept every idea shared.



See

Materials: Glow stick

Explain: Do you know that glow-worms are not really worms? Do you know that fireflies are not really flies? Glow-worms are actually young fireflies (luminous larvae) that squirm forth from firefly eggs. Fireflies are soft-bodied beetles. Glow-worms live in the ground eating slugs and snails for almost two years until they change (metamorphose) into fireflies. The light (bioluminescence) glow-worms and fireflies make is a chemical process. Chemical energy makes the glow you see in glow-worms and fireflies. Fireflies can control the rate that their light flashes by putting air into their luminescent organs. Fireflies use their lights to attract mates. Fireflies of the same species recognise each other by the number of flashes used, the frequency of flashes, and the colour of the light. Isn't that interesting?

Experience: Use a glow stick to demonstrate a chemical process. When a glow stick is broken, two chemicals mix together which creates the illumination. See how many other glow-in-the-dark objects the children can name. Some examples are:

- Glow-in-the-dark toothbrushes
- Cat's eye road markers
- Glow-in-the-dark stickers and stars
- Electric eels
- Some orthodontic retainers also glow in the dark

Do

Get Ready: Glow-in-the-dark objects (large plastic stars, rulers, or pencils – enough for each student to have one), classical or jazz instrumental music

Get Set: Partially darken the room. Give each student a glow-in-the-dark object. Play some classical or jazz music.

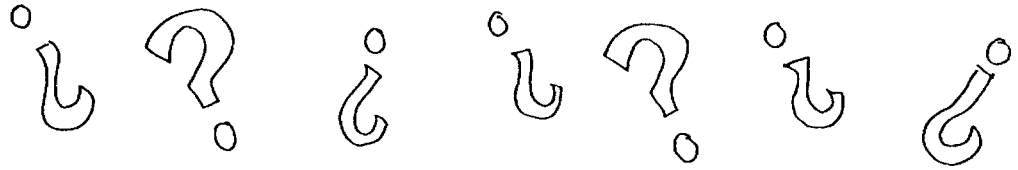
Go: Remind students that fireflies of the same species recognise each other by the number of flashes used, the frequency of flashes, and the colour of the light. Challenge the children to hold their glow-in-the-dark objects behind their backs and invent little dances and move in ways that represent fireflies. Encourage the children to work in small groups to coordinate movements using their hands, feet and glowing objects.

Does a Person or a Snake Shed Its Skin More Often?

Hear

Ask: Does a person or a snake shed its skin more often?

Share: Discuss all the possibilities. Do not indicate a correct or incorrect hypothesis. Accept every idea shared.



See

Materials: Magnifying glasses, hand cream, pumice soap, liquid soap, water

Explain: Does a person or a snake shed its skin more often? A rattlesnake sheds its skin (moults) three or four times each year. A human sheds about 600 000 particles of skin every hour – about 70 grams a year. By the age of 70, the average person will have shed 50 kg of skin. People shed and regrow outer skin cells about every 27 days, so we have almost 1000 new skins in a lifetime. That is a lot more than a snake! Skin is amazing, isn't it? We especially shed skin when we bathe and wash our hands.

Do

Experience: Have the children use magnifying glasses to study the skin on their hands. Next, have them apply a lot of hand cream and then look at the skin again. When finished, have the children use warm water and pumice soap to clean their hands. Rinse and use liquid soap to wash again. Then apply another coat of hand cream. Look again at the skin under magnification. Notice the new feel of the skin.

Get Ready: Various hand coverings (rubber gloves, leather work gloves, gardening gloves, oven gloves), various round fruits (apple, orange, lemon, grapefruit, peach, plum)

Get Set: To determine how the skin sends messages to the brain, play a guessing game.

Go: Pair children. One member of each pair puts on one of the hand coverings and closes his or her eyes. The partner places one piece of fruit in the covered hand. The child holding the fruit must try to determine the kind of fruit without the fine sense of touch.

Further Exploration: Have the blindfolded children wear gloves and try to distinguish between three surfaces: smooth, knobby, and rough sandpaper.

Take It Home: To encourage children to share the knowledge they are learning with family and friends, teach them this riddle: 'What is the largest human organ?' (Answer: The largest human organ is the skin. The surface area of the skin is about 2.3 square metres.)