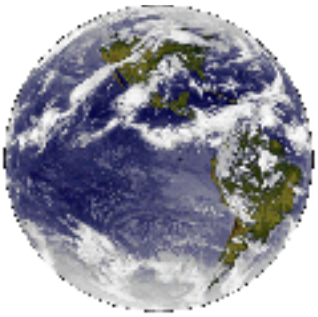

Observing the World Around Us

An Introduction for Teachers and Parents

Our everyday experience of the world around us is an invitation to question and explore and wonder:

During the day, we see a bright sphere called the Sun move across the sky. Its path is fairly regular from day to day, but changes gradually during the 365-day seasonal cycle. Why doesn't the Sun always rise in the same place each day? Where does it go at night? How does its light cast shadows on our world?

We experience the alternation of daylight (day) and darkness (night). Clocks show us that the total time needed to complete one day and one night always is 24 hours, but the proportion of daylight and darkness varies for different 24-hour periods. Also, we can see that the Earth never is completely light or dark at one time. How can it be 12 PM in Boston, 5 PM in London, and 9 AM in San Francisco at the same time? Who has the right time?

Much of the Earth's population experiences a repeating pattern of temperature and weather changes over a 365-day period. Weather in the most populated areas goes from generally cool days (spring) to hot days (summer) to cool again (fall) and then to cold (winter) and back to cool. These seasonal changes affect animal and plant life dramatically. Seasons have different lengths and varying character at different locations on the Earth. How can we have winter in the USA and summer in Australia at the same time, if they both turn toward the Sun once a day?

People have wondered about these and other aspects of our ordinary experience, observing and pondering and guessing about the world we live in. They have constructed "models" to explain the phenomena around us and have refined and changed and discarded these explanations based on further observations and reflections. Much of our current understanding is built upon the inspiration of observers and inquirers starting before Plato (427-347 BC); we owe much to the inspired work of Nicolas Copernicus (1473-1543), Johannes Kepler (1571-1630), and Sir Isaac Newton (1642-1727).

Today we know that the Earth is a sphere that turns on its axis once every 24 hours. The Earth revolves around the Sun, a very large and very hot sphere of gas situated millions of miles away from us. One such revolution takes approximately 365 days. The Earth is tilted on its axis of rotation with respect to the Sun, and this tilt,

coupled with the Earth's movement around the Sun, causes the alternation of our seasons. The Moon, in turn, is a smaller solid sphere that revolves around the Earth about every 28 days. It reflects the light of the Sun and shows us its "phases", depending upon the relative position of the Sun, Earth, and Moon.

Although these and other modern scientific explanations can become complicated and even can run counter to our intuition, they really are rooted in the everyday experience of people who wondered about the world around them. This is the essence of science: to be explorers of our own world, to engage ourselves in the Spirit of Inquiry by observing what is around us, asking questions and looking for answers that are consistent with our experience. And although we cannot hope to reconstruct all scientific understanding from first principles, each one of us can be a scientist with regard to our own experience. We can observe the world and wonder about it and see how our observations and deductions mesh with scientific knowledge.

As a point of focus, everyone "knows" that the seasons are "caused" by a tilted Earth revolving around the Sun. But what does this really mean? How can we know that the Earth is tilted? How can we know it revolves around the Sun? And what do the Earth's revolution and tilt really have to do with seasons, anyway? Can we find something in our experience that lends credence to these notions, so that we can deeply understand the facts and not just believe them because we are *told* that they are so?

An Inquiry-Based Classroom

In our Everyday Classroom Tools project, we are seeking to immerse elementary school students in the Spirit of Inquiry, to help them begin to observe and learn from their experience. Our project is rooted in a connected, progressive set of observations and questions which we can use to explore the world around us. We look for answers that are consistent with our experience and with the accumulated knowledge of humankind. At all times we try to keep ourselves rooted in our own observations. We strive to maintain a connection between what we are exploring now, what we have learned in the past, and what we hope to understand in the future. What the Everyday Classroom Tools project wishes to stress is that before there were encyclopedias, there were authors, and before there were scientific facts, there were curious people trying to explain the world around them.

There are more questions we could ask ourselves about the world around us than we present here, because for every observation, there can be many more questions we find and want answered. Hopefully, those questions will be ones which appear in our classrooms from eager and inquisitive students. The first question we asked ourselves when we embarked on this project was "Where do we start to build a curriculum based on these principles?"

Our efforts to date have taken the form of the **Threads of Inquiry**, a series of free-flowing dialogues about inquiry-inspiring investigations that maintain a solid connection with our experiences and with one another. The Threads are meant to be a jumping-off point for teachers, suggesting an approach to the Spirit of Inquiry

without dictating too much of the content. They are backed by more formal on-line activities, and they also operate in accordance with contemporary concepts in science education for elementary students (such as the National Science Education Standards).

Accompanying this curriculum is a comprehensive look at inquiry as a method of learning, a companion document addressing the benefits and strategies for educators bringing inquiry into their classrooms. **The Keys to Inquiry** is a useful resource for anyone interested in research on and methods of inquiry-based learning. It is written to be used with the Threads of Inquiry.

The major theme explored in this curriculum is the pattern of change on planet Earth as it relates to the Sun. So many different subjects can be usefully mapped to this set of investigations of the world around us that it gives educators an opportunity to build upon an inquiry framework with their own related and connected ideas from different disciplines.

Here is a look at each of the different investigations and their main aims with regard to skills and science learned:

Main Skills and Topics Covered by this Curriculum

Name of Thread	Skills and Science Learned
To Seek or Not to Seek?	**Skills**: Observing, collecting, question asking, examination of data, recording of data, changes, patterns, science as a tool. **Topics**: Life cycles.
Hello, Sun!	**New Skills**: Measuring, modeling, predicting, theory building. Using our body as a measuring tool. **Topics**: Sun's path in the sky, Sun's height in the sky, Sun-Earth motions, length of day, degrees on the sky.
You Light up My Life	**New Skills**: Manipulating objects and tools, experimenting with postulates. **Topics**: Nature of light and how shadows are made.
Me and My Shadow	**New Skills**: Thinking about information in different ways, believing a theory by testing it. **Topics**: Nature of light and shadow geometry.

Guess My Shape	**New Skills**: Thinking in more dimensions, bringing our experiences from outside back into the classroom, educated guesses. **Topics**: Nature of three dimensional space, geometry of solids, nature of shadows hitting three dimensional objects.
This is a Stickup!	**New Skills**: Careful data collection, working with real number data, drawing conclusions from our own data, making models of our experiment. **Topics**: Speed of Sun's path across the sky, triangles and angles, degrees on the sky.
Latitudes and Attitudes	**New Skills**: Using three very different yet sound methods for finding an answer, combining number data and recent experience to draw conclusions. **Topics**: Latitude and longitude, calculating our latitude, angles, triangles, degrees on the sky.
Time Warp	**New Skills**: Telling time, building tools to tell time, thinking about time and relative position on the world. **Topics**: Time and subtraction of times, time zones, Sun's path across the sky with relation to relative time, degrees and angles.
Tilt-A-World	**New Skills**: Combining data with observations, believing what we are experiencing by testing the data in terms of math and models. **Topics**: Value of the Earth's tilt, orbit of the Earth around the Sun, seasons, climates.
Through Thick and Thin	**New Skills**: Building a theory about the changes we have seen all year by using our experiences and data about shape, the movement of the Sun, the tilt of the Earth, the passage of time, and the nature of light, to believe in the changes we have seen all year. **Topics**: Graphing, using tilt angles, calculating area and temperature, wrapping up.