

## Curriculum Introduction

This curriculum, developed by Kavita Venkateswar and Professor Daniel Cohan of Rice University, aims to engage young children in scientific inquiry and hands-on measurement of the atmosphere. The lessons enable students to apply math and science to explore the challenge of air pollution in their own communities.

### Content:

The curriculum is aimed at 5<sup>th</sup>-grade level math or science classes and consists of seven lessons:

1. **Introduction to the Atmosphere:** States of matter; Intro to the atmosphere
2. **Physical Properties of the Atmosphere:** Layers of the atmosphere; Temperature; Wind; Begin GLOBE measurements
3. **Atmospheric Gases and Their Cycles:** Composition of the atmosphere; Water cycle, clouds & humidity; Nitrogen cycle; Oxygen cycle; Carbon cycle
4. **Stratospheric Ozone:** Dual nature of ozone; Stratospheric ozone layer
5. **Air Pollution:** Tropospheric ozone; Particulate matter; Air Quality Index
6. **The Greenhouse Effect and Global Warming:** Greenhouse gases; Climate change; Carbon footprint; Alternative sources of energy
7. **Synthesis:** Graphing and analysis of student-collected data

The curriculum involves students in air pollution and meteorology measurements using protocols developed by the GLOBE Program (Global Learning and Observations to Benefit the Environment; [www.globe.gov](http://www.globe.gov)). The GLOBE protocols used here—cloud cover, humidity, surface and air temperature, wind direction, and surface ozone—are specifically aimed at elementary students. For Texas classrooms, this curriculum covers many of the Texas Essential Knowledge and Skills (TEKS) tested on the Texas Assessment of Knowledge and Skills (TAKS) exam. Targeted TEKS are listed in the front of this package and at the top of each lesson.

### Goals:

This curriculum is an inquiry-based program. This means that the lessons are not completely based on lecture and rote memorization of facts. Instead, under the

guidance of an instructor, students are given enough background knowledge and tools to explore relationships within the data they collect. In particular, students will create their own experimental hypotheses regarding how air pollution relates to the weather conditions that they measure. The Lessons also engage students in activities such as brainstorming exercises, in-class demonstrations, and computer games to boost their understanding of Earth Science.

The content and activities cover important science and math learning objectives to build students' knowledge base. At the same time, the experience of engaging in scientific inquiry is intended to spur students toward a curiosity and excitement for ongoing pursuit of scientific learning.

### **Set-Up:**

Each Lesson contains a Teacher's Guide, student worksheets, and an answer key. The Teacher's Guide includes the following material:

- Objectives for the Lesson
- Targeted science and math TEKS (for TAKS exam in Texas)
- Background information on the topic
- Key vocabulary
- Expected student outcomes
- Resources for additional information and activities
- Step-by-step guide listing the discussions and activities to be conducted

Depending on available time, teachers may omit some of the listed activities, or utilize the outside resources for additional enrichment. Teachers may also choose to spread a Lesson over more than one day. However, teachers must plan ahead to handle the logistics of the GLOBE measurements (Lessons 2-6), which are designed to be taken during the first five minutes and last five minutes of an hour.

The student worksheets serve as a journal for students to record their ideas, observations, and results as they proceed through the lessons. This allows students to keep their work in one place and provides an assessment tool for teachers to gauge student progress.

**Implementation:**

Lessons must be done in sequence. However, the lessons are designed so that they can either be done all at once, or they can be taught one at a time, spread out over the course of an entire year.

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