A Word to the Teacher

Before You Begin

Gateways to Science (*Gateways*) is not just a textbook; it is an instructional program designed around you, your elementary students, and the Texas Essential Knowledge and Skills (TEKS). It includes the structure, organization, balance, and presentation of content to meet the diverse needs of all students in the science classroom. Based 100% on the conceptual development of the state-mandated curriculum, the program promotes student success on the State of Texas Assessments of Academic Readiness (STAAR®), for which you and your students are held accountable.

The instructional program of *Gateways* is based on five guiding principles taken from the recommendations of the *National Science Education Standards*, the *Benchmarks for Science Literacy*, and other prominent works in the area of science education.

Science is for all students.

All students can achieve success in science if given the opportunity. Multiple experiences spaced over several years are required to develop the understanding of most scientific concepts and processes.

Learning science is an active process that includes both individual and social processing.

Effective science instruction requires both physical and mental activity on a regular and consistent basis. Students must have opportunities to develop understanding by sharing and refining their thinking individually and through peer interactions.

Students must accept and share responsibility for their own learning.

Teachers must set expectations for each student to take responsibility for his or her work in both individual and group settings.

Teachers must consistently model the habits of mind necessary for scientific literacy, including values, attitudes, communication skills, and critical thinking.

Curiosity, skepticism, honesty, willingness to communicate, and a strong persistence to think critically and solve problems must all be demonstrated and encouraged by the teacher.

Curriculum, instruction, and assessment must be aligned.

Teachers must maximize every minute of instructional time by remaining true to a close alignment among the components of curriculum, instruction, and assessment.

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Teacher Edition

The lessons in the teacher edition are organized in a five-step learning sequence called the 5 E Model of Instruction. This sequence has proven to be a successful way for all students to actively learn science as well as other content. The model suggests that students rely on both prior experiences and firsthand knowledge gained from new explorations whenever they learn something new or understand something familiar in greater depth.

Let's Engage!

The first E introduces students to a new lesson. During these brief activities, students will make connections between something they learned in the past and something new they are about to learn. Students bring prior knowledge about how the world works, but it is sometimes based on limited experiences and sometimes on misconceptions.

Let's Explore!

The second E has students actively explore what they are learning. Students work as a team to plan, share, and discuss ideas as they learn about the topic. These activities are often, but not always, classroom or lab investigations. Experiences must occur before explanations. Students acquire a common set of experiences that allow them to help each other understand the concept through social interaction.

Let's Explain!

The third E puts students into meaningful discussions with their peers and teacher. After sharing information, students revise their thinking and with the teacher record a classroom science notebook entry that reflects their new understanding. When students engage in meaningful discussions with other students and the teacher, they can pool their explanations based on observations, construct new understandings, and have a clear focus for additional learning.

Let's Elaborate!

The fourth E has students apply or broaden their knowledge by using it in a different situation. These activities include making products, reading to learn, and additional classroom and lab investigations. Providing additional active learning opportunities for students to incorporate into their mental construct allows them to confirm and expand their understanding.

Let's Evaluate!

The fifth E gives students an opportunity to show what they have learned and are able to do. These activities allow both the student and the teacher to monitor and reflect on progress. In learner-centered instruction, it is important for students to be aware of their own progress as an outcome of instruction.

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Throughout *Gateways*, students are required to maintain a written science notebook or interactive notebook. Lessons are written so that the teacher guides students to record their thoughts, observations, collected data, drawings, and other information on a regular basis.

The teacher edition is divided into the following six major units:

- Physical Science, Part 1
- Physical Science, Part 2
- Earth Science, Part 1
- Earth Science, Part 2
- Life Science, Part 1
- Life Science, Part 2

Student Readers

The *Gateways Kindergarten* kit includes several student readers designed to engage students in science content and support reading in the content area. Each student reader contains text and pictures to be used as explanations and reinforcements for the learning that will take place during the lessons. The *Gateways Kindergarten* kit includes three student copies of each student reader for use by individual students or in centers. The student readers are designed to be used in conjuction with the activities for maximum experience and success in science.

Photo Cards

The photo cards included in the kit are for use with lessons and for facilitating class discussion. Instructions for use are provided in the teacher edition.

Instructional Strategies

Gateways uses active, varied instructional approaches during the units of study. Students learn the “whys and hows” of science rather than just the “whats and whens.” The built-in variety of instructional strategies helps motivate both teachers and students, while the built-in consistency of the lesson structure provides a familiar, nonthreatening learning environment.

Strategies for Activating Prior Knowledge

Brainstorming

Brainstorming is a process used to generate ideas for individuals or for groups. There are no “dumb ideas.” Sometimes seemingly foolish ideas serve as a catalyst for other ideas. Brainstorming is not a debate, and it is not an evaluation of ideas. The quantity of brainstormed ideas is more important than the quality.

Possible organizational strategies to involve everyone in the process:

- Teacher announces that everyone must generate three ideas on three separate sticky notes. Sticky notes are brought into a small-group discussion; all ideas are added to the group’s list.
- A round-robin session involves every student contributing one idea to a group listing. Students may have permission to pass after the first round and the session continues until all group members have passed during a round.

Useful guidelines for brainstorming (Harmin, 1994):

- Accept every idea without judgment. Unusual ideas may generate new and valuable ideas.
- Write all ideas as they are offered. No judgment is involved at this point. Keep open minds during brainstorming.
- Generate ideas quickly. High energy and quick pace can lead to creativity and unusual ideas. If ideas are generated too fast for one recorder, utilize two or more recorders alternating writing during the process.

Mental Imagery

Research shows that engaging students in the creation of nonlinguistic representations stimulates and increases activity in the brain. The most direct way to generate nonlinguistic representation is to simply create a mental picture (Marzano, Pickering, & Pollock, 2001).

Strategies for Creating Learner-Centered Instruction

Stations

Classroom design and arrangement can directly facilitate or interfere with the learning climate in the classroom. Good spatial definition can help students feel secure by specifying for them where the structured learning areas begin and end. The spatial definition can define circulation patterns in the room during lab investigations, which also can define appropriate interaction patterns and help to guide students' work and behaviors. The way the stations are designed can ease the transition from one instructional activity to another.

Stations can be arranged visually to focus students' attention by—

- Using labels and signs to designate areas
- Using colors to attract visual attention and define spaces
- Taping lines on the floor or wall to define different work areas
- Moving furniture to define spatial boundaries
- Displaying group work, like a poster, to designate that group's space

Stations set up in the classroom should be arranged so that students have easy access to each other, to the teacher, and to the materials they need for the specific learning assignment (Johnson, Johnson, & Holubec, 1994).

Cooperative Learning

Cooperative learning involves students working together to find success by accomplishing shared goals and involves students separated into small groups. The small groups work to increase each student's learning as well as the group's learning. Cooperation among students supports retention, motivation, task focus, achievement, and higher level thinking and reasoning. Working together, students develop a group relationship that is personal, social, and academic. Group work strengthens social competencies, supports student self-esteem, and enhances an individual's ability to cope with stress and adversity (Johnson et al., 1994).

Traditional cooperative learning in the science classroom involves students working together to achieve a common success. The group shares a common purpose that motivates each member beyond individual interests. Group members hold one another accountable for the quality of work accomplished. Group members promote each other's success by helping, explaining, and sharing. Group members are required to develop social skills to work effectively as a team. Groups can analyze how effectively goals are accomplished and can often summon the necessary motivation to increase the quality of learning. Ultimately, grouping encourages students to perform at a higher academic level than they probably would have if they were to work alone.

Lab Grouping

Students should be assigned to groups when they work together. One of the main reasons to use grouping is to ensure that each student actively participates (Johnson et al., 1994). Some decisions that must be made about lab groups include:

Determining the size of the group—

- Shorter time periods need small groups.
- Available materials or the specific nature of investigation may determine group size.
- Four students in a lab group support 12 interactions and help with role assignments:
    - Principal investigator: leads discussion to maintain group's focus and brings group to consensus
    - Materials manager: obtains and returns materials
    - Recorder: maintains group's written record; makes sure others keep individual records when needed
    - Reporter: presents group's work
- With fewer than four students, the reporter/recorder roles can merge; with more than four students, several can serve as recorders.

Assigning students to lab groups—

- A decision must be made to group homogeneously or heterogeneously.
- Advantages to heterogeneous grouping include:
    - Multiple perspectives and problem-solving methods
    - Increased cognitive disequilibrium to stimulate learning
    - More frequent give-and-take of explanations
    - Enhanced quality of reasoning and discussion
    - Increased long-term retention
- Heterogeneous groups often are randomly assigned but can be teacher organized to maximize specific effects to accommodate isolated students, at-risk learners, disruptive behaviors, etc.

Keeping lab groups together—

- Over the course of a semester, students should have the opportunity to work with different classmates within a lab group.
- Groups should remain stable long enough to at least complete the specific lab tasks and recognize success.

- Students can be told that grouping assignments will change and that they will ultimately have the opportunity to work with everyone, or nearly everyone, in the class.

Strategies for Organizing Information

Learning is more powerful when students routinely take information presented in one format and represent it in an alternative way. Learning and retention can be improved by integrating information from both the verbal and the visual-spatial forms of representing and organizing information.

Concept Mapping

A concept map visually displays information by using main ideas and labeled lines. The concept map identifies relationships between important ideas and concepts, and it demonstrates a deeper, conceptual student understanding. Many students find it easier to make sense of information when it is presented in a visual format. The concept map can help students organize information by compressing, focusing, identifying connections, and supporting interpretation.

- Select a unit of work for concept mapping.
- Identify the major/minor concepts. Each concept may be put onto a separate piece of paper in order to rearrange them.
- Rank the concepts from most general to most specific.
- Arrange the most general concept at the top.
- Link this concept to the most specific concepts using straight lines.
- Label all lines with linking words that explain the relationship. Maps usually, but not always, read from top to bottom.
- Crosslinks can be used to show even more connections and relationships (Skoog & Lien, 1988).

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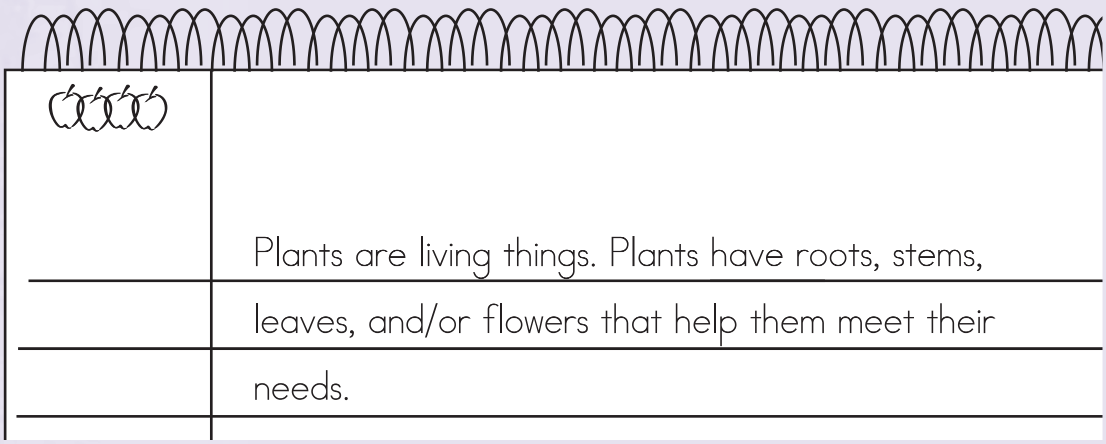
Notebooking

Keeping a science notebook is an effective way for students to save information about experiences for future use and provides a way for students to reflect upon those experiences (Marcarelli, 2010). Throughout *Gateways Kindergarten*, there are class science notebook opportunities. Kindergarten students should also maintain a science notebook. The teacher edition provides instruction for students to record class science notebook entries, their thoughts, observations, collected data, drawings, and other information throughout the year.

The class science notebook should be written on chart paper with a blue or black marker and written large enough for students to see from a short distance away. It should be displayed in a location where students can access it for reading and copying. Sample entries to assist in the development of notebooking skills for both student and teacher can be found throughout the teacher edition as shown.



Using the class science notebook will allow the teacher to guide the writing process and build critical-thinking skills by "thinking aloud," asking higher level questions, and modeling the use of scientific language as notebook entries are created. It will also give opportunities for students to be more successful as they process the information and build their understanding of the content. Involving students in the creation of notebook entries allows them to take ownership of the new knowledge while modeling how to keep a notebook like a scientist.

Students will have many opportunities to make predictions and explain their thoughts in their notebooks. The student science notebook should include paper for taking notes and recording data but may take different forms. Teachers may choose to use blank or lined pages stapled together with reproducible master pages, a composition book, or a spiral for students to record information and attach reproducible masters.

Learning to keep a science notebook is developmental for both students and classroom teachers.

The process of notebooking:

- Creates a space for students to reflect about experiences and encourages insight into activities
- Allows students opportunities to create
- Encourages students to process what they are learning
- Allows for the free flow of students' ideas and feelings
- Gives a broader perspective over time and encourages students to reread and identify recurring themes
- Provides students with a safe format to communicate in a healthy and constructive way
- Involves student expression and exploration of thought

Venn Diagrams and T-Charts

Having students identify similarities and differences among concepts being learned enhances their understanding of and ability to use knowledge (Marzano et al., 2001). The use of a simple T-chart to have students organize their initial thinking while identifying the similarities and differences can be useful. A more sophisticated graphic called a Venn diagram has students display the similarities between elements in the intersection between two overlapping circles. The differences are placed in the parts of each circle that do not intersect.

Physical Models, Simulations, and Drawings

In general, physical models are concrete representations of knowledge, while simulations are representations of a process. Drawings may represent knowledge, process, or both. Models, simulations, and drawings are powerful ways to generate nonlinguistic representations in the mind. Each time students engage in transferring information into a new format that makes their thinking visible to others, their understanding increases.

Digital Cameras in the Science Classroom

Digital cameras can serve several purposes in the science classroom. To help students build vocabulary skills, have students take photographs to represent science terms being studied. Or introduce photos to students, asking them to identify science terms represented in images. Digital cameras can be used as data collection devices and as tools for creating digital collections of items such as leaves or insects.

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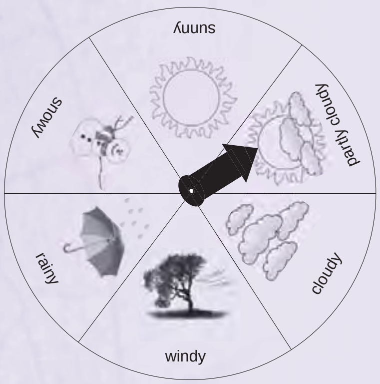
Daily Observations and Descriptions

Kindergarten students should observe and describe weather changes from day to day and identify events that have repeating patterns, including seasons and day and night. Weather observations and descriptions should be incorporated into daily classroom instruction from the beginning of the school year. Weather will be addressed formally in Unit 3: Earth Science, Part 1. The Weather Calendar and Weather Symbols are provided on the Teacher Resource CD for use with or as your classroom calendar. The Weather Wheel (Unit 3, RM 3) may also be used to make day-to-day observations of the weather.

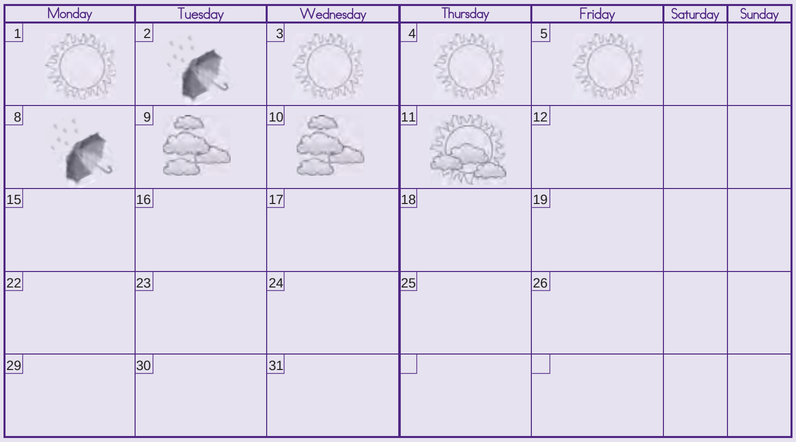
Sample Daily Weather Observations

Weather Wheel

The weather today is partly cloudy



Weather Calendar



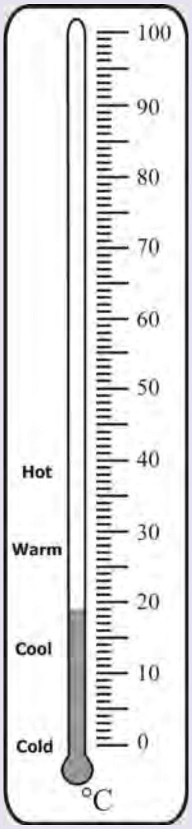
During the first few months of school, as a class, observe and describe the weather and use the weather symbols to complete the weather calendar. Over time, allow students to complete the weather calendar with their own illustrations. Save the weather calendar from month to month to observe and compare the weather day to day, month to month, and over seasons.

Students entering kindergarten may have limited experience in reading a thermometer. However, at this time, kindergarten students need only learn to identify whether the temperature displayed is hot or cold.

You will need a classroom demonstration thermometer and a Celsius thermometer, or access to the Internet, to make observations. A classroom demonstration thermometer may be purchased from education supply catalogs or stores. [Note: When using a classroom thermometer, adjust the red band to display the temperature.]

You may find daily temperature readings via the Internet or by placing a Celsius thermometer outside in a shady location that receives good airflow.

Label the classroom demonstration thermometer as shown to help students associate the relative temperature with the actual temperature. Remember, scientists use the Celsius scale when measuring temperature.



Teacher Edition

Teacher pages include a materials list, basic instructions for each lesson, facilitation questions and answers, hints and suggestions for implementation, snapshot visuals of handouts and reproducible masters from the Teacher Resource CD, and answers to the questions and activities in the student edition. Pages from the student edition are embedded throughout the lesson to allow for ease of use when observing directions and activities. The *Gateways* Features page illustrates these components.

Teacher Resource CD

The CD included with each teacher edition of *Gateways* includes reproducible masters for making lab station cards, manipulatives, and handouts for student distribution.

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Gateways to Science Features

UNIT 1: Physical Science, Part 1

Lesson 2: Using Your Senses

Learning Goal

Use your senses to learn about physical properties.

Materials

For teacher
- chart paper or class science notebook
- marker
- timer or clock with second hand

For each student
- 1 half-sheet of drawing paper
- pencil
- crayons

For student groups
- large plastic cup (32 oz)
- large athletic sock
- small orange

Engage

Advance Preparation

- Create a mystery cup by placing an orange inside each cup. Place the cup inside a large athletic sock.
- Prepare enough mystery cups for your students to work in groups of 4–5.
- Prepare one sheet of chart paper (or a page in the class science notebook) by drawing a large cup, as shown.

Learning Goal
provides a brief outlook of lesson purpose.

Advance Preparation
allows for preplanning to ensure lesson goes smoothly.

Materials List
aids in lesson preparation.

Teacher Instruction

- Gather students to make an entry in the class science notebook about science safety rules.
- Possible science notebook entry:

I will follow the science safety rules. I will do my part to keep myself and others healthy and safe.

Science Notebook Entry
provides a sample/possible science notebook entry.

Materials

Station 1
- yellow, red, and blue washable finger paint or tempera paint
- 3 small bowls
- paper towels
- trash can
- cotton swabs (3 for each student)

For each student
- RM 6

Elaborate

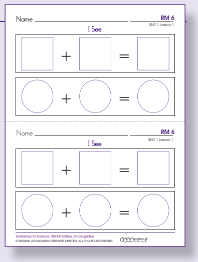
Teacher Note

These stations can be set up and monitored over time by utilizing two stations the first day and three stations the second day. Read through the Elaborate and prepare for what works best for your students.

Station 1

Teacher Instruction

- Pour one color of paint (red, blue, or yellow) into a bowl. Repeat for each color.
- Provide *RM 6: I See* to students.
- Instruct students to dip one end of a cotton swab in the red paint and dab the red paint on the first and last squares of *RM 6*.
- Instruct students to dip the other end of the cotton swab in the blue paint and dab the blue paint on the middle and last squares of *RM 6*.



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5 Es
are clearly labeled to help keep track of lesson progress.

Teacher Note
provides helpful tips and information.

Reproducible Master (RM) Snapshots and Answer Keys
offer an at-a-glance view. RM Answer Keys are placed in lesson to reduce the amount of printed materials.

Stations
signals teacher to consider classroom setup and/or grouping.

Facilitation Questions

assist in guiding and scaffolding instruction.

Safety Alert Icon

reminds teacher and students of safe lab practices.

Keep magnets away from all computers and electronic equipment.

Facilitation Questions

- Were all the objects magnetic? *No, not all the objects were magnetic.*
- Do we have other magnetic objects/materials in our classroom? *Answers will vary depending on the objects available in your classroom.*
- How do we use magnets in our classroom? At home? *Answers will vary and may include that we use magnets for holding things on the refrigerator, picking things up, and holding things together.*

Station 2

Teacher Instruction

Materials

Station 2
For each student
- RM 12

For teacher or station
- nonstandard units—teddy

- Provide *RM 12: Fill It Up!* to students.
- Set each tray of materials in an area large enough for each group to explore.
- Instruct students to work with the cup and the nonstandard units first.
- Instruct students to fill the cup with teddy bear counters and to count the teddy bear counters as they place them in the cup.

I Can Be Safe

Unit 1: Physical Science, Part 1

Student Reader

I can be safe on the bus.

6

I can be safe on the playground.

7

I can be safe in my classroom.

8

11

Student Pages

are embedded in all lessons for convenient reference.

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