Organizing for Effective Content Area Reading Instruction

Designing an effective reading program involves defining what one means by the word literacy and developing a conceptual framework based on that definition. Another important step in designing reading program concerns identifying the strategies that good readers use to understand the text, and designing instructional strategies based on these reading strategies.

Definition of Literacy (Jetton & Dole, 2004)

<table>
<thead>
<tr>
<th>Literacy is constructive</th>
<th>Readers use their existing knowledge to construct an understanding of text.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy is fluent</td>
<td>Readers master the basic processes to the point where these processes become automatic.</td>
</tr>
<tr>
<td>Literacy is strategic</td>
<td>Readers are aware of their purpose for reading, the nature of the materials, and whether what they read makes sense. Based on this awareness, readers employ strategies or plans to help them solve problems while reading or writing. These strategies occur before, during, and after they read.</td>
</tr>
<tr>
<td>Literacy is motivated</td>
<td>Readers have goals for learning, they are interested in and informed by what they read, and they believe that they are capable of reading.</td>
</tr>
<tr>
<td>Literacy is a lifelong pursuit</td>
<td>Readers continuously practice, develop, and refine their reading.</td>
</tr>
</tbody>
</table>

Three key components must be considered when examining the reading process. Figure 1 graphically displays these components.

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**The Reader.** There are factors within the reader that are crucial to their literacy development. Readers use their prior knowledge in order to connect what they already know with the ideas in the text. Readers do this, for example, by integrating ideas in the text they are reading with existing ideas they already have or with other texts, or by challenging the text in light of their own experiences and knowledge. Through wide reading of a variety of texts, readers are able to expand their background knowledge through the vocabulary and knowledge they acquire.

Another very influential factor is readers’ attitudes or interests in reading. Readers’ interests are strong when students have a goal or purpose for reading, when they have sufficient prior knowledge, and when they can connect the text to their own lives. Their attitudes are most positive when they believe that they can be successful at reading, and when they feel that they are supported in the community, home, and school environments. To generate interest, teachers need to provide students time to read, ownership over what they read, and opportunities for personal and critical response to what they read. Their personal responses allow them to integrate ideas in the text with their own feelings, emotions, images, and associations. Critical responses allow students to stand apart from the text and analyze, synthesize, and evaluate the author’s ideas.

**The text.** The text plays a critical important role in the reading process. Readers must understand that there are many functions for language that operate within texts and
that there are a variety of text genres that includes stories and informational texts. Students must possess a clear understanding of the authors’ purposes for constructing particular texts, and how these different texts are organized. They must also understand how authors craft texts through the discourse devices they employ such as sarcasm and humor. In turn, an understanding of these devices will enable students to critically analyze and evaluate the quality of the texts they read and compose. Lastly, writing and reading are related in that writing is an important tool for a reader to use in conveying his or her understanding of the text and responding to the text. Through writing, students gain a deeper understanding about the texts they read.

**Reading processes.** Teachers must also understand the essential processes involved as students read. While reading, students must develop the automaticity to recognize words and read them effortlessly and with expression while evidencing their understanding of what they read. To increase their understanding of what they read, they employ strategies for comprehending the text that include activating prior knowledge, predicting, paraphrasing, inferring, and monitoring their reading. In becoming a strategic reader, students come to understand which strategies they need to employ at a certain time and place and how to use those strategies effectively to increase comprehension.

During reading instruction, teachers should utilize a variety of modes of reading that include teacher reading in which students hear models of fluent reading, reading in which student practice fluent reading with knowledgeable others, reading in which the teacher guides the students through the reading by modeling reading strategies that increase word recognition, fluency, or comprehension, and independent reading in which students practice reading on their own. Teachers and students also participate in lessons
Reading Strategies Model (Jetton & Dole, 2004)

Readers are aware of their purposes for reading, the nature of the materials, and whether what they read makes sense. Based on this awareness, readers employ strategies or plans to help them solve problems while reading or writing. These strategies occur before, during, and after they read. In turn, teachers employ specific instructional strategies that teach students to use these reading strategies before, during, and after they read. Figure 2 graphically displays the relationship between the reading strategies that students need to understand text before, during, and after the reading process, and the instructional strategies that teachers must employ to help them use these reading strategies.

Reading Strategies for Comprehension

Set a Purpose

Readers understand that there are three purposes that operate in a secondary classroom—reader, author, and teacher. Reader-determined purpose occurs when the reader must read with no instruction, and he/she must determine the information to ultimately remember and learn. Oftentimes this purpose is guided by student interest. Students must be able to read the text with ease in order to effectively read with this purpose. If the text is too difficult, students need instruction. Author-determined purpose occurs when students are reading to understand the ideas conveyed by the author through
the main points and details. In literature, author-determined purpose usually focuses on the literary elements such as plot, character, setting, and theme. With science, math, and social studies, author-determined purpose focuses on the main ideas and details of the text. Teacher-determined purpose is set by the teacher. Oftentimes, the teacher has a specific purpose or agenda for reading the text and conveys this to the student.

**Analyze the Reading Task**

In school, most readers are assigned some sort of task when they read. The most common task is answering questions. Oftentimes, students don’t even read the text in order to answer the questions; instead they skim the text for the answers. Readers need to know the task because they will read differently depending on the task. For example, students who are asked to respond personally to the text will read it differently than if they are asked to outline or summarize the text. Thus, readers need to know the task before they read.

**Activate/Build Prior Knowledge**

Readers already possess some knowledge when they enter the secondary classroom. If they activate the knowledge that they already know related to the concept they are learning in class, they will be able to connect the new information to their existing knowledge, and they will be remember the new information better and longer. When students have no existing knowledge of the concept, teachers must build that knowledge by finding existing knowledge that connects to the information they do not know. For example, when students are studying fungi in their biology class, they may not know the types of fungi, but the teacher can build this knowledge by accessing their knowledge about athlete’s foot, since it is a fungi that most of the students know.

**Consider Interest**
When good readers confront text, they consider how interested they are in the topic. If they are interested, they immediately jump into the text. If they aren’t interested, they must find ways to motivate themselves to read the text such as provide rewards for reading, read in a quiet place, and/or take notes while they read to keep their minds from wandering to more interesting topics. Interest and knowledge are highly related, so if readers have the requisite knowledge of a topic, they are usually more interested. Teachers can increase interest by building the knowledge of a topic. Teachers can also increase interest by making the topic more relevant to students. That is, students will have more interest in a topic that personally relates to them. Readers are often more interested in topics that are related to the human condition that include love, family, death, illness, and disaster. Thus, when a math teacher wants to interest his/her students, he could contrive an experience for his students in which a natural disaster such as an earthquake occurs, and the students have to use math to calculate the damage of the disaster.

**Preview the Text**

Good readers preview the text in order to determine how much information they already know and how interested they are in the topic. Previewing allows readers to view the subtitles, bold-faced words, charts and graphs, and the end-of-the-chapter questions, so they know what to expect when they learn.

**Analyze the Text Structure**

Authors organize their ideas by using basic organizational structures such as description, narration or chronology, classification, compare/contrast, exemplification, problem/solution, and cause/effect. When authors use these structures, they incorporate signal words that cue the reader to that particular text structure. For example, when an
author writes cause/effect, she often uses signal words such as “as a result, therefore, thus, if…then, because,” and “the resulting effect.” Authors often use several text structures when they write. For example, a science chapter on pollution might include descriptions of the pollution, the types of pollution, the causes and effects of the pollution, and the problems and solutions for ridding the planet of pollution. Readers have to recognize the signal words that tell them that an author is beginning a new structure within the text, and they need to know these structures well enough that they can use the structures to remember information. Teachers can employ graphic maps to help students learn these structure. As shown in Figures 3 and 4, graphic maps visually display the text information, so students can easily see the organization of the ideas.

Insert Figures 3 and 4 about here

Determine Importance

Determining importance is highly related to the reader’s purpose. If a reader is using reader-determined purpose, the information that he determines important is usually related to his interest. If a reader is using author-determine purpose, importance is based on the information that the author provides. Readers rely on the teacher’s signals when the teacher provides the purpose.

Some texts, particularly informational texts, will incorporate highly interested but not very important information just to grab the reader’s attention. For example, a science chapter on fungi might show a man with a pig on a leash hunting for truffles. Readers using author-determined purpose can become distracted by these seductive details, highly interesting but not important information, and they will not learn the important information in the text.

Actively Construct Meaning
Readers cannot be passive readers, hoping the information will just fall in their heads as they read. They need to actively process the text by predicting information to come, clarifying words, phrases, and sentences that are confusing, summarizing, and asking questions. These strategies are critical to remembering the information in the text.

**Monitor Progress**

Readers need to think about their own thinking as they read. They need to realize when they don’t understand an idea in the text. This realization will allow them to use a fix-up strategy such as rereading or clarifying a part of the text. Readers also need to realize when they really do understand the ideas in the text. Readers might ask the following questions as they monitor the text:

- Are there any words that I don’t understand?
- Is there information that doesn’t agree with what I already know?
- Are there any ideas that I don’t understand because I can’t tell who or what is being talked about?
- Are there any ideas that I don’t understand because I can’t tell how the ideas are related?
- Are there any ideas that I don’t understand because I think the ideas are contradictory?
- Is there any information missing or not clearly explained?
Explicit Strategy Instruction

Teachers need to teach the reading strategies explicitly to the students. This involves the following steps (Fielding & Pearson, 1994).

- Teacher explains the strategy
- Teacher explains why the strategy is important
- Teacher models how to perform the strategy
- Teacher explains when to use the strategy in actual reading
- Guided practice--teachers and students work through several examples of strategy use
- Fading--teacher gradually turns over responsibility of strategy use to the students
- Independent practice--students continue to use the strategy on their own
Instructional Strategies

Teachers can employ a variety of instructional strategies that teach and reinforce the reading strategies that good readers use. As secondary teachers use these instructional strategies, they are not only teaching their content, they are also teaching and reinforcing effective reading strategies as they engage students with text. These instructional strategies occur at different times during the reading process. Some instructional strategies occur before the students begin reading the text. These strategies help readers set a purpose before they read, activate or build their prior knowledge, and build interest in the text. They include:

- Brainstorming
- List-Group-Label
- PreP
- Anticipation Guide
- K-W-L
- Guided Imagery
- Text Preview
- Analogies
- Semantic Mapping/Advanced Organizers
- Story Impressions
- Probable Passages

Other instructional strategies are taught as students engage in the text in order to construct meaning by determining importance, predicting, summarizing, clarifying, and questioning. They include:

- Analyzing Text Structure
- Reciprocal Teaching
- DRTA/DLTA
- Request
- Say Something
- Imaging Chart
- Knew New Q
- GRP
- Think Alouds
- Summarizing
• Somebody Wanted But So…
Brainstorming

Brainstorming is used to set a purpose for the lesson, activate or build prior knowledge, and get students interested in the text’s concept(s). This activity helps students become aware of how much they know about a topic, and it captivates their interest much more than the more traditional, perfunctory review.

Steps:
1. Identify a key concept that is reflected in the text. Be sure to determine a concept that is specifically appropriate to the text. Don’t use “birds” as your topic if the text only focuses on “owls.”

2. Students work in small groups to generate a list of words or phrases listed vertically on paper that are related to the key concept. Be sure that students are working in groups—social activities encourage students to generate more knowledge because they are triggering the knowledge in one another.

**Brainstorming: Sine, Cosine, and Tangent**

If teaching a math lesson on finding the sine, cosine, and tangent of an angle, the teacher can have students brainstorm what they know about triangles.

Example list:
Equilateral
Angles are measured in degrees
Isosceles
Scalene
Hypotenuse
Acute
Area = ½ base x height
Right triangles have 90 degree angle
All angles add up to 180 degrees
Obtuse
Equilaterals have all angles and sides equal
Sides are called legs also
Hypotenuse is the side across from the 90 degree angle
Pythagorean Theorem
Named with letters of the angles
Right Triangle
Right Angle is 90 degrees
List – Group – Label

List-Group-Label is very similar to Brainstorming, but the benefit of this activity is that students organize the knowledge that they have generated.

Steps:
1. Identify a key concept that is reflected in the text. Be sure to determine a concept that is specifically appropriate to the text. Don’t use “birds” as your topic if the text only focuses on “owls.”

2. Students work in small groups to generate a LIST of words or phrases listed vertically on paper that are related to the key concept. Be sure that students are working in groups—social activities encourage students to generate more knowledge because they are triggering the knowledge in one another.

3. Students GROUP the brainstormed list by identifying words that have something in common. Several variant groupings are usually possible, and a particular word often fits in more than one group.

4. Students LABEL the groups with a key word that describes the commonality among the words in the group.
**List-Group-Label: Sine, Cosine, Tangent**

Using the list generated by the students during the brainstorming activity (LIST), students work together to GROUP the words in phrases. There are several different methods of grouping. After the students have grouped the list, each group should be given a LABEL. Example:

<table>
<thead>
<tr>
<th>Types of Triangles</th>
<th>Angle Characteristics</th>
<th>Triangle Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equilateral</td>
<td>Angles are measured in degrees</td>
<td>Area = $\frac{1}{2}$ base x height</td>
</tr>
<tr>
<td>Isosceles</td>
<td>Acute</td>
<td>All angles add up to 180 degrees</td>
</tr>
<tr>
<td>Scalene</td>
<td>Obtuse</td>
<td>Hypotenuse</td>
</tr>
<tr>
<td>Right Triangle</td>
<td>Right angle is 90 degrees</td>
<td>Sides are also called legs</td>
</tr>
<tr>
<td>Right triangles have 90 degree angle</td>
<td></td>
<td>Hypotenuse is the side across from the 90 degree angle</td>
</tr>
<tr>
<td>Equilaterals have all angles and sides equal</td>
<td></td>
<td>Pythagorean Theorem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Named with letters of the angles</td>
</tr>
</tbody>
</table>
The Prereading Plan is similar to Brainstorming, but the main advantage of PReP is that students elaborat\textcolor{red}{}e on their prior knowledge. For students with limited prior knowledge, hearing an elaboration about a concept from another student is extremely useful.

Steps:
1. Identify a key concept that is reflected in the text. Be sure to determine a concept that is specifically appropriate to the text. Don’t use “birds” as your topic if the text only focuses on “owls.”

2. Teacher says, “Tell anything that comes to mind when you hear the word…” Each student volunteers initial ideas that come to mind and the teacher writes each word or phrase on the board.

3. Teacher points to each word and asks the student who stated that word, “What made you think of …?” Other students listen to each student’s elaboration of knowledge about each word/phrase.

4. After students have had an opportunity to elaborate on their ideas, the teacher asks, “Based on our discussion and before we read the text, have you any new ideas about…?” Because the student have had a chance to elaborate on their prior knowledge, the responses elicited during this phase are often more refined.
PReP: Insects

1. A teacher wants to compare the 5 classes of complex invertebrates and decides to conduct a PReP activity on insects. The teacher asks the students:
   “What comes to mind when you hear the word *insects*?”
The students come up with ideas while the teacher writes them on the board. Example:
   - Wings
   - Insects are gross!
   - Antennae
   - Spiders

   - Bite
   - Three body parts
   - 6 legs
   - They destroy stuff

2. Next, the teacher asks the students how they came up with their ideas. This is a chance for students to clarify, revise, accept, and integrate their ideas. Example:
   - Teacher: “Mary, you said ‘wings.’ Why?”
     - Mary: “Because a lot of insects fly, so they have to have wings.”
   - Teacher: “Okay, can you name some insects that fly?”
     - Mary: “Bees, flies, lightning bugs.”
   - Teacher: Trang, you said, “Insects were gross.” What made you think of that?
     - Trang: I was thinking about a time when I was living in Florida and a cockroach flew into my room and landed on my bed while I was sleeping. When I opened my eyes, all I could see were these antennae moving, and I screamed.

3. After students elaborate on the knowledge they have about all of the words that they generated on the list, the teacher asks the students to use the list and the discussion to think of associations they have made. Example:
   - Teacher: “Now that we have an idea of what we have talked about insects for a while, have you come up with any new ideas?”
   - Teacher: “Great! Bill, what made you think of spiders?”
     - Bill: “I HATE spiders! They are nasty bugs.”
   - Stacey: “Don’t spiders have 8 legs?”
   - Class: “Oh yeah!”
   - Teacher: “Well, that’s interesting. If a spider has 8 legs, then is it an insect?”
A few minutes later…
Paul: “I have a question. Amy said insects destroy stuff, but don’t bees carry pollen around so flowers can grow or something like that?”
Amy: “Oh yeah! We read a book about that last year. They carry pollen from flower to flower so they can grow!”
Anticipation Guide

An anticipation guide is a group of statements that students respond to before reading the text. The students make predictions and contrast them with the text. Anticipation guides can have different formats but their purpose is always for readers to activate prior knowledge, and make predictions and connections.

**Steps in constructing an Anticipation Guide:**
1. Analyze the material to be read and identify the major concepts to be learned.
2. Write the major concepts in short, clear, concise statements. The teacher must use their knowledge of the students’ background and determine how the main concepts will interact with the students’ beliefs to construct these statements.
3. Put these statements in a format that allows for anticipation and prediction. They can be ordered as they are discussed in the text or most to least important.

**Steps in Implementing an Anticipation Guide:**
1. Students individually complete the Anticipation Guide prior to reading the text.
2. As a class, discuss the students’ predictions before reading the text. Allow for a wide range of responses as students use their varying background knowledge.
3. Students read the text selection and evaluate their responses to the Anticipation Guide as compared to the author’s ideas.
4. As a whole class, discuss how the students’ predictions compare and contrast with the author’s intended meaning.
Anticipation Guide

Rational and Irrational Numbers
Place an R next to each item that you think is a Rational Number. Place an I next to each item that you believe is an Irrational Number.

_____ 1. ½

_____ 2. Cannot be expressed as a repeating decimal

_____ 3. 9 ¾

_____ 4. Denominator is zero

_____ 5. Can be written as a ratio of two integers

_____ 6. \(\sqrt{\frac{49}{64}}\)

_____ 7. \(\sqrt{21}\)

_____ 8. 0.54

_____ 9. 2.717711777

_____ 10. \(\pi\)
Anticipation Guide

Adding positive and negative integers

For each of the following statements, place an A in the BEFORE column if you agree. If you disagree, place a D in the BEFORE column. Next, read the section in your book on positive and negative integers and in the AFTER column, place an A if you agree with the statement or a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>1. If a football team gains 8 yards on a pass and then loses 3 yards, they have gained in total yardage.</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>2. You have $20 dollars. You pay $10 a CD and $2 on ice cream. You still have enough money to go to the movies, which costs $9.</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>3. It is a freezing -4 degrees outside, but the weatherman says it will heat up 8 degrees in the next hour. In an hour, the temperature will be above zero.</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>4. You go hiking, starting at your base camp and hike for 5 miles, turn around towards base camp and hike for 4 miles. You have gone past base camp and should turn back around.</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>5. When you add two numbers, the sum is always more than zero.</td>
<td></td>
</tr>
</tbody>
</table>
History Anticipation Guide
“Laying the Foundations of Government”

Please read the following true and/or false statements. Place an X next to each statement that **YOU** believe is relatively true. Discuss your responses with a partner, explaining **WHY** you think each statement is true or false.
After reading the text, place an X next to each statement that is true according to the **AUTHOR**.

<table>
<thead>
<tr>
<th>YOU</th>
<th>AUTHOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Honesty, patriotism, and dignity are good characteristics for president.</td>
</tr>
<tr>
<td></td>
<td>Responses:</td>
</tr>
<tr>
<td></td>
<td>2. Mothers are responsible for teaching their children to be good citizens.</td>
</tr>
<tr>
<td></td>
<td>Responses:</td>
</tr>
<tr>
<td></td>
<td>3. Washington, D.C. served as the first capital of the United States.</td>
</tr>
<tr>
<td></td>
<td>Responses:</td>
</tr>
<tr>
<td></td>
<td>4. In the beginning of our nation, most people worked in factories.</td>
</tr>
<tr>
<td></td>
<td>Responses:</td>
</tr>
</tbody>
</table>
**Anticipation Guide for English**

**“The Pedestrian”**

by Ray Bradbury

**Directions:** Before reading the story, I want you to think about what city life would be like in the year 2053. Read the predictions below and decide if you agree or disagree that those predictions will occur by 2053. For each statement, mark an X in the appropriate blank in the *Before Reading* column and provide a reason for your answer. After you read, mark an X in the appropriate blank in the *Post Reading* column to show whether the author would agree or disagree with each prediction.

<table>
<thead>
<tr>
<th>Before Reading</th>
<th>Post Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree / Disagree</td>
<td>Agree / Disagree</td>
</tr>
<tr>
<td>______ / ______</td>
<td>______ / ______</td>
</tr>
<tr>
<td>1. People will watch more television.</td>
<td>______ / ______</td>
</tr>
<tr>
<td>Reasons:</td>
<td></td>
</tr>
<tr>
<td>______ / ______</td>
<td>______ / ______</td>
</tr>
<tr>
<td>2. No one will walk for pleasure.</td>
<td>______ / ______</td>
</tr>
<tr>
<td>Reasons:</td>
<td></td>
</tr>
<tr>
<td>______ / ______</td>
<td>______ / ______</td>
</tr>
<tr>
<td>3. There will be fewer police.</td>
<td>______ / ______</td>
</tr>
<tr>
<td>Reasons:</td>
<td></td>
</tr>
<tr>
<td>______ / ______</td>
<td>______ / ______</td>
</tr>
<tr>
<td>4. Writing will be the most valued profession.</td>
<td>______ / ______</td>
</tr>
<tr>
<td>Reasons:</td>
<td></td>
</tr>
</tbody>
</table>
Guided Imagery

Guided Imagery allows for students to visualize concepts prior to reading. Guided Imagery is important because students can:

- Activate/Build knowledge
- Foster self-image
- Explore concepts visually
- Solve/clarify problems
- Explore their imagination

As preparation for the prereading lesson, teachers find a story in which the author has described several excellent images throughout the story. For example, in “All Summer in a Day,” the author, Ray Bradbury, describes what it is like for the children living on a planet where it has been raining nonstop for 7 years. In fact, the sun only comes out for one hour every 7 years. Teachers borrow Bradbury’s words to write a short description of the images in the story (see example).

The teacher tells students that good readers think about what they already know before they read the story. Some readers do this by picturing what they know. The teacher tells the students to close their eyes and listen as she reads this short description aloud. While she is reading, the students are picturing the words based on the prior knowledge that they possess.
Guided Imagery for English
“All Summer in a Day”
By Ray Bradbury

Directions to the Students: Good readers think about what they already know before they even start reading the story. One way in which they do this is that they think about what they know by picturing what they see. If I asked you the picture yourself on another planet like Mars, close your eyes, and picture what you see. (Discuss what they pictured). Now I want you to picture some of the events in our story today. Close your eyes as I talk to you and try to see what I am describing in pictures.

Picture yourself living on a planet where it has been raining since you were born; it rains and rains--thousands upon thousands of days compounded and filled from one end to the other with rain, with the drum and gush of water, with the sweet crystal fall of showers and the constant sound of storms pelting the ground, the steady beating of the rain on the windows. A thousand forests have been crushed under the rain and grown up a thousand times to be crushed again. This is the way of life forever on this planet.

Because you have been living on this planet of rain and storms all of your life, you have never seen the sun. You don’t even know what it looks like. Maybe it is like a lemon or a gold coin. You also have never felt the warmth of the sun on your body, on your face, arms, and legs. All you feel is wetness and the cold damp of the rain.

The rain has washed out all of the color in the world. The gray color of rain has drowned the blue sky, the green grasses, and the red sunsets. Day after day you peer out the window and see the dim wet world and the cold gray skies. You gaze out your window at this world you live in and hear the gigantic sound of the rain falling in tons and avalanches, everywhere and forever.

Now that I have described what it feels like to live on a planet of neverending rain, turn your partner and share what you liked and disliked about living on this planet. Now open your eyes and let’s discuss the pictures you saw!
Guided Imagery for Science: Hurricane

Before we talk about today’s topic, I want you to close your eyes and see pictures in your mind as I talk to you.

Picture yourself lying on your bed in a hotel room at the beach. You are looking out your second floor window at palm trees bending so far over they seem to be touching the ground. The beach you laid on yesterday has disappeared under a massive tide of water. The only thing louder than the rain pounding everything around you is the wind blowing like the sound of a train. It has been raining for hours now, and water has flooded the main strip where families were once playing.

You are thinking you should have evacuated like the newsmen instructed hours ago. All of a sudden a massive wave of water is coming at your window! This massive wave, called a storm surge, hits the building and you hear the building creak and the loud crack of the windows breaking out. Water starts flooding the apartment in a matter of seconds—and you are trapped!

In about five minutes, the bed is floating half way to the ceiling. As the building begins to fall apart, you float out the window and grab onto a sofa pillow that came by. You become tangled in wires and debris in the dreary, murky water. The wind pummels your face, and you hold onto anything you can, but the winds and waves were so strong that every time you grab hold of something, it is ripped from your hands. The boards, wires, and debris are slamming into you, cutting and bruising your face, neck, and arms.

After hours of floating around, the storm begins to calm down. You breathe a sigh of relief, knowing that you are still alive and the storm is over…

Or is it?

Now that I have described what it feels like being in the midst of a hurricane, turn to your partner and think of what will happen next. Is the hurricane over and are you in the clear? What would you do now?
Guided Imagery for History  
The Dropping of the Atomic Bomb during WWII

Imagine that you and your family are in downtown Washington C.D., and you are walking in the mall toward the National Gallery. You have waited a long time to see a new exhibit of Picasso. Laughing and joking, you stroll with your family, surveying the monolithic buildings of the city. All of a sudden you look in the sky and see a ball of blindingly intense light. You are simultaneously plunged into total, unseeing darkness. Screams of pain echo throughout the city as it descends into chaos. The black cloud of dust that had instantly turned day into night soon forms a mushroom cloud over the entire city. You wander in confusion, looking for the rest of your family. Others wander in total shock amidst the countless numbers of lifeless bodies. You watch the city ablaze with fire as exposed hot wires ignite the contents of the crumbling buildings. What were once tall buildings are now mounds of concrete rubble.

You turn to your right and see a little girl, her skin peeling off her face, chest, and hands. She is black all over—you suppose that dirt had stuck to her where the skin had peeled off. Her whole body is coated with it, and the blood trickling from her wounds makes red streaks in the black. She runs to a nearby fountain and plunges in to relieve her burning body.

Now that I have described what it feels like to live through the dropping of an atomic bomb, turn to your partner and discuss why Oppenheimer, the physicist who spearheaded the project to create an atomic device, recalled the words of a Hindu holy book: “Now I am become Death, the destroyer of worlds.”
KWL

KWL is a process in which teachers present a concept and ask the students to list what they already know (K) about the particular concept. The ideas are written down in a column titled “Know.” Through this part of the activity, students are activating their prior knowledge, a critical prereading strategy. Students are then instructed to write about what they want to know about the concept. For high school students, this might be phrased as “write or tell what they do not know about the concept.” They write these ideas in the “W” column. This activity is valuable in that it helps the students realize the gaps in their knowledge concerning the concept. Following this part of the KWL activity, the students read the text selection. 

As they read, they write down information that they learned. Once everyone has finished reading, the class discusses what they learned by addressing their pre-reading ideas, summarizing and integrating key ideas. They revisit the “K” column and note those ideas that they already knew, and they revisit the “W” column to note the information that might address some of the gaps of knowledge that they had about the topic prior to reading the text selection.

Here is an example of a KWL chart on Graphing Linear Equations in Slope-Intercept Form. The teacher asks the students what they know about Slope-Intercept form:

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KNOW</strong></td>
<td><strong>WANT TO KNOW</strong></td>
<td><strong>LEARNED</strong></td>
</tr>
<tr>
<td>Slope is rise over run</td>
<td>What is the y-intercept and what intercepts what?</td>
<td>If you aren’t given 2 ordered pairs, you can find the equation if you are given the y intercept and one point on the line</td>
</tr>
<tr>
<td>Slope intercept equation is ( y = ax + b )</td>
<td>I thought slope was m</td>
<td>Wherever the line crosses the ( y ) axis, your “b” is that number</td>
</tr>
<tr>
<td>Slope is vertical change over horizontal change</td>
<td>What happens to the line when slope is negative?</td>
<td>Slope can be either “m” or “a,” but most calculators use “a.”</td>
</tr>
<tr>
<td>“a” is the slope and “b” is the y-intercept</td>
<td></td>
<td>The y intercept is where the line crosses the ( y ) axis</td>
</tr>
<tr>
<td>If you know the ( x ) value and the slope, you can find the ( y ) value</td>
<td></td>
<td>When the slope is negative, the line tilts down from left to right</td>
</tr>
<tr>
<td>If you have two ordered pairs you can find the slope</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L</th>
<th><strong>LEARNED</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If you aren’t given 2 ordered pairs, you can find the equation if you are given the y intercept and one point on the line</td>
<td>Wherever the line crosses the ( y ) axis, your “b” is that number</td>
</tr>
<tr>
<td>Slope can be either “m” or “a,” but most calculators use “a.”</td>
<td>The y intercept is where the line crosses the ( y ) axis</td>
</tr>
<tr>
<td>When the slope is negative, the line tilts down from left to right</td>
<td></td>
</tr>
</tbody>
</table>
1. Find short examples of specific text structure types. These examples can be found in subheadings of subject matter textbooks, newspapers, magazines, and internet sites.

2. **Model** for the students how to determine the text structure:
   
   a. Read the text selection together
   
   b. Identify any words that signal or cue the reader to a particular structure. **Cue or signal words** for some common text structures are listed below.
   
   c. **Graph the text** according to its structure by using a graphic map. The graphic map should be constructed by the teacher before the class begins in order to create a graph that maps identically to the text. Don’t use generic maps.

### Cue Words for Common Text Structures

**Description**
- words that signify sights, sounds, tastes, and touch

**Sequence**
- first, second, third; next; then; finally

**Comparison**
- different; in contrast; alike; same as; on the other hand; both; similarly; however; but; in comparison; in the same way

**Cause/Effect**
- because; as a result; therefore; if…then; due to; thus

**Problem/Solution**
- the problem is; solved; one way to resolve it; difficulties

**Exemplification**
- for example, for instance, one such case, to illustrate

**Classification**
- type; group; class; category; sort; kind
Analyzing Text Structure

The Water Cycle

Hydrosphere is a term that describes all the water on Earth’s surface. Water moves constantly between the atmosphere and the hydrosphere in the water cycle.

If you watch a puddle in the Sun, you’ll notice that over time the puddle gets smaller and smaller. Energy from the Sun causes the water in the puddle to change from a liquid to a gas by a process called evaporation. Water that evaporates from lakes, streams, and oceans enters the Earth’s atmosphere.

If water vapor in the atmosphere cools enough, it changes back into a liquid. This process of water vapor changing to a liquid is called condensation.

Clouds form when condensation occurs high in the atmosphere. Clouds are made up of tiny water droplets that can collide to form larger drops. As the drops grow, they fall to Earth as precipitation, which completes the cycle by returning water to the hydrosphere.

From Glencoe’s Earth Science Text ****Cite****

1. Read the text together.
2. Locate some words that signal a specific text structure. For this, we will use a cause and effect text structure:
   Example:
   If (you watch a puddle…)
   Causes
   If (water vapor in the atmosphere…)
3. Using a graphic map that was created before class, illustrate the text structure to the students. Example:
Analyzing Text Structure

Graphing an Ordered Pair

A coordinate plane is formed by a horizontal line, called the x-axis, and a vertical line, called the y-axis. An ordered pair, is the location of a point. The first number is the x value while the y value is the second number. The two numbers are always in parentheses and are separated by a comma. Example: (3, 4).

To graph the ordered pair (3, 4), begin at the place where the x-axis and the y-axis meet, called the origin. Look at your x value, which is three. This is how many places you moved horizontally. Since the number is positive, we move to the right three spaces. Next, we see that our y value is 4. We now move either up or down 4 spaces. Since our number is positive, we move up 4 spaces. Finally, make a dot at the space you are at. The point you just made has the location of (3, 4).

1. Read the text together.

2. Locate some words that signal a specific text structure. For this example, we will use a sequence text structure.
   Example:
   First
   Next
   Begin
   Finally

3. Using a graphic map that was created before class, illustrate the text structure to the students. Example:
**Introduction**
An ordered pair is the location of a point.

**Step 1**
Begin at the origin.

**Step 2**
Move horizontally. The number of spaces you move is your x-value. Positive means you go to the

**Step 3**
Move up or down the number of spaces in your y-value. Positive number

**Step 4**
Make a dot.

**Conclusion**
The dot is the location of the ordered pair.
Reciprocal Teaching

Reciprocal Teaching can be done in multiple ways. One way is as a whole class where the teacher models the correct procedure and then has a student or group of students assume the role of teaching. Another way is to have the students form small groups and switch off, each student in the group playing the role of teacher. All models, however, contain 4 basic components: Predicting, questioning, summarizing, and clarifying. In the example below, the teacher will model the process of Reciprocal Teaching and the students will form groups to finish reading the text selection.

1. Read the title of the text and ask the students what they expect or would like to learn from the selection. Summarize the group’s predictions and add a few of your own (if appropriate).
   Teacher: What is the title of our chapter today?
   Monique: Arranging the Elements: Discovering a Pattern.
   Teacher: Good. We should already know what elements are, right? Does anyone want to remind us of what an element is?
   Will: It’s something that cannot be separated physically or chemically.
   Teacher: Okay, knowing that, and knowing the title of our selection, Tell me in your own words what you think we will read about.
   Mike: I think it will be about what is inside an element and how they’re made up.
   Teacher: Great!
   Laura: Maybe how elements form together or something.
   Teacher: That’s another good prediction.
   Amy: How elements are alike?
   Teacher: Alright, these are some excellent predictions. Let’s start reading.

2. Read a small portion of the text.

3. Ask a question related to the content. Have students share some other questions they have.
   Teacher: What sort of pattern did Mendeleev discover?
   Allen: He found there was a repeating pattern when the elements were arranged.
   Teacher: How are they arranged?
   Jenn: By atomic mass.
   Teacher: Allen said there was a repeating pattern. What pattern was repeating?
   April: The properties of the elements.
   Teacher: Good. Does anyone have any questions?

4. After addressing the students’ questions, summarize what has been read.
   Teacher: My summary is in the 1860’s, a scientist named Mendeleev looked at the names and properties of elements and discovered that when the elements were arranged by atomic mass, there was a repeating pattern to their properties. Does anyone have anything they would like to add?

5. Clarify anything that the student find unclear.
   Teacher: Is there anything that is unclear in this paragraph?
   London: Are all the properties repeating?
   Danielle: But I thought we learned there were like 100 elements? This says
there are only 60.

Paige: But how did Mendeleev lay the elements out on his table?
Teacher: Good questions. Many properties of elements show a certain pattern, so yes, the repeat. Danielle and Paige mention two ideas that we will find out soon.

6. The students form small groups and repeat this process amongst themselves, switching the role of teacher from student to student after each stopping point.

Another method is to provide students with the following guide and work in small groups to complete it. Students are told when to stop reading and then summarize, clarify, question, and predict what will happen. Here is an example using one group:

Tanner: I think the summary should be that Mendeleev found that properties of elements have a repeating pattern when they’re arranged by their atomic mass.

Zach: Add in increasing atomic mass. I think that might be important. (Students write down their summary on their handout.)

John Robert: Does anyone know what density is? I don’t really remember.
Tanner: That’s from the first chapter we did. Its mass divided by volume, so how much matter is in a given space. Let’s write that down.

Zach: I wonder how the elements are arranged. Did Mendeleev make a line or a couple lines or a circle or what?
Tanner: Yeah, that’s a good one. Also, do all the properties have a pattern? We should write those down.

Zach: Alright. What are some quiz questions we should write down?
John Robert: Who found patterns in the properties of elements?
Zach: That’s a good one. Mendeleev. How are the elements arranged?
Tanner: Increasing atomic mass.
John Robert: Okay. Let’s predict what next. I actually think Zach’s question will be answered. It talked about the arrangement in the last sentence, but it didn’t say what the arrangement looked like. They’ll probably talk about that next. So I think the elements are arranged in lines going straight across, maybe like a multiplication table or something?
Reciprocal Teaching Worksheet

Name _____________________  Title ____________________

Directions: Please choose a place to stop in the text, and summarize, clarify, and question the information that you just read. Then, predict the information to come next. After that, read another portion of the text, and choose another place to stop, and practice the same strategies.

First Stop (line _________________________ )

Summarize:

Clarify

Words I don’t know:

Sentences or paragraphs I don’t get:

Questions:
  I wonder why…

Quiz questions:

Predict:

Second Stop (line _______________________________)

Summarize:

Clarify

Words I don’t know:

Sentences or paragraphs I don’t get:

Questions:
  I wonder why…

Quiz questions:

Predict:
Third Stop (line ____________________________ )

Summarize:

Clarify

Words I don’t know:

Sentences or paragraphs I don’t get:

Questions:
  I wonder why…

Quiz questions:

Predict:

Fourth Stop (line ____________________________ )

Summarize:

Clarify

Words I don’t know:

Sentences or paragraphs I don’t get:

Questions:
  I wonder why…

Quiz questions:

Predict:
ReQuest

1. Both students and the teacher silently read a common segment of the text selection. Text passages of varying length are suitable in applications to a classroom. For example, both teacher and students begin by reading a paragraph or two.
2. The teacher closes the book and is questioned about the passage by the students.
3. Next there is an exchange of roles. The teacher now asks the students about the material.
4. Upon completion of the student-teacher exchange, the class reads the next segment of text. Steps 2 and 3 are repeated.
5. At a suitable point in the text, when students have processed enough information to make predictions about the remainder of the assignment, the exchange of questions stops. The teacher then asks prediction questions: “What do you think the rest of the assignment is about?” “Why do you think so?” Speculations are encouraged.
6. Students are then assigned the remaining portion of the selection to read silently.
7. The teacher facilitates follow-up discussion of the material, relating the discussion to previously asked questions. Were they answered?

Modifications:

a. Assign alternating students to the role of questioner after each question (this involves more students).

b. ReQuest teams can be formed. A ReQuest team composed of three or four students is pitted against another ReQuest team.

c. Teach students about the different types of questions: Literal, interpretive, and applied. Then, make certain they ask a variety of questions. The teacher’s role is to provide a good model of questioning.
Example of ReQuest
Types of Waves

1. Students and teacher read part of text silently.
2. Teacher closes book and is asked questions about the reading. At first, students will ask more factual questions. It is important for students to ask some more interpretive and applied questions, so the teacher should model this. In this example, students already know how to ask these types of questions.
   Kristi:  What are the two types of waves?
   Mr. Cash: Transverse and Longitudinal. Steven?
   Mick: The text says “transverse” means “moving across,” but then says that the particles in a transverse wave move perpendicular to the direction that the wave is traveling in.
   Mr. Cash: Well, we know that perpendicular lines form 90 degree angles and look like a “+” sign. Well, when the text says the particles move perpendicular to the wave direction, that means they are moving across the direction of the wave. So, the particles are moving up and down, while the wave travels to the right.
3. Students, with books closed, are asked questions from the teacher.
   Mr. Cash: Describe/demonstrate how a rope can be used to demonstrate a transverse wave and its properties.
   Faith: Well, the wave will be moving from left to right. The particles move perpendicular to the wave, so up and down. The text actually says they vibrate, I think.
   Mr. Cash: Great! Now, someone come up and show the two properties we learned about using the rope.
   Amanda: Well, the tops of the waves are the crests.
   Mr. Cash: Good-the crests are the highest points on a wave. Continue.
   Amanda: Yeah, and the lowest point of a wave right here is called the trough.
4. The next part of the text is read, and steps two and three are repeated.
5. At a suitable point the question exchange stops. The teacher then asks prediction questions.
   Mr. Cash: What do you think the rest of the assignment is about?
   Lindsey: The other types of waves-Longitudinal waves.
   Mr. Cash: Okay, and what do you think Longitudinal waves are?
   Daniel: Long waves? Waves that are longer than Transverse.
   Mr. Cash: Why do you think that?
   Daniel: Because “Longitudinal” has the word “long” in it.
   Grace: I think they’re going to be vertical.
   Mr. Cash: As in move vertically?
   Grace: Yeah.
   Mr. Cash: Oooh! Why is that?
   Grace: Well, Longitudinal, longitude. Like lines of longitude on a map run up and down.
   Mr. Cash: That’s true. What do lines of longitude measure, though? What I
mean is, do they measure how far north or south something is, or how far west or east something is?

Pete: West and east I think. Longitude lines are vertical, like the prime meridian, but they measure how far west or how far east a place is.

Mr. Cash: Good. Let's keep these ideas in mind as we continue reading the rest of the section.

6. Students now read the rest of the selection.
7. The teacher facilitates a follow-up discussion, relating the discussion to questions asked earlier.

Mr. Cash: Now that we have read about longitudinal waves, does anyone want to relate that to our discussion about lines of longitude?

Jeff: I think I can. The text said that longitudinal waves vibrate back and forth. Instead of going up and down and having crests and troughs, there are compressions and rarefactions. It's like if lines of longitude were pushed into each other and collided, then continued colliding.

Mr. Cash: Okay, all of you have been talking about the how the two types of waves are related. That is a good idea with this type of text because strategic readers determine the type of text structure of their reading. So why don't we compare transverse and longitudinal waves. Who would like to start?

Sarah: Well, like Jeff said, longitudinal waves have compressions and rarefactions. Transverse waves have crests and troughs.

Whitney: And transverse wave particles move perpendicular to the direction of the wave. Longitudinal wave particles move back and forth along the direction of the wave.

Mr. Cash: Good! Anyone else?

Gary: Sound waves are longitudinal waves. Electromagnetic waves are Transverse waves.

Mr. Cash: Great job.
Directed Reading-Thinking Activity (DR-TA) (Baumann, 1992; Stauffer, 1976)

Directed Reading-Thinking Activity (DR-TA) moves students through a process that includes prediction, verification, judgment, and extension. The teacher uses careful questioning to guide reading, stimulate thinking, and prompt responses through interpretation, clarification and application. There are three questions that should be used frequently throughout the activity:

i. “What do you think?” (or “What do you think will happen next?”)
ii. “Why do you think so?” (or “What part of the text gave you a clue?”)
iii. “Can you prove it?” (or “What else might happen?”)

Steps (general):

1. Allow students to look at the title, graphics, subheadings, or even read the first part of the selected text. Ask students what they think the selection will be about. Encourage all of the students’ predictions. Ask questions such as:
   - “What do you think this story (reading, selection, etc.) will be about?”
   - “Why do you think that will happen?”
   - “Why do you think the reading will have that information?”

2. Have the students read the selection and tell them to use their predictions as the purpose for their reading. Throughout the activity, never refute any predictions. The atmosphere created is important, and any predictions should be supported by the teacher and justified by the student. Remember to allow for the proper amount of think time.

3. Discuss how the predictions relate to the text. Repeat the questions posed in step one. Some of the student’s predictions might be refined while others can be created. To encourage clarification and thinking ask, “How do you know?”.

4. Continue reading and repeat the process in step three.

5. Continue reading and discussion in step three until the end of the text. Remember to select stopping points carefully; too many can distract from the main purpose while too few can create confusion.

Steps (informational text):

1. Set the purposes for reading by having students look over the title, graphics, subheadings, or even read the first part of the selected text and consider prior knowledge. Ask, “From reading just the chapter title (subtitles, etc.), what do you think the author will present in this section (chapter, passage, selection)?” Record thoughts on the blackboard/overhead and ask students, “Why do you think so?” Encourage discussion and predictions.

2. Determine the amount of reading/stopping points based on the discussion and difficulty of the reading text. If there are several stopping points, remember to repeat step one each time.

3. Students read silently and the teacher helps students with comprehension, word recognition, etc. Remind students to reflect on their predictions while reading.
4. Discuss the predictions as they compare to the text. Have students refine, create, etc. any predictions and to justify why they choose to do so. Whole class or small group discussions are both valuable.
Directed Reading Thinking Activity
“Story of an Hour”
by Kate Chopin

As the Ms. Gett and her students begin reading the story, she asks her students to predict the story by looking at the title and the author.

Ms. Gett: Students, take a look at the title and tell me what you already know about our story. Some of you might even know the author, Kate Chopin. She often writes about the same theme, so knowing the author also helps you predict the story. What do you know? Sam: I think the story will take place in an hour.
David: Yeah, someone gets killed which ends the story very quickly.
Sue: It might be a dream that lasts only an hour and a whole story happens in the dream.
Pallavi: I have read Chopin’s *The Awakening*, and she always writes about women’s experiences.
Alice: Yes, and her women don’t always like their lives. They are oppressed.
Ms. Gett: These are some great predictions. Let’s read part of the story and see if any of our predictions occurred. Let’s read the first three paragraphs silently. As you read, be thinking about the predictions we just made and whether they happened in the text. Then, see if you can make more predictions based on the three paragraphs you just read.

The teacher and students read. After everyone has read the three paragraphs, Ms. Betts begins the discussion again.

Ms. Gett: Did any of our predictions occur?
Sam: Well, we still don’t know if the story will take place in an hour.
David: Someone already died, Mrs. Mallard’s husband.
Mrs. Gett: You predicted that he would be killed. Was he?
David: Yeah, by a train.
Sue: It could still be just a dream.
Ms. Gett: We predicted that Chopin writes about women. Is this story from a woman’s point of view?
Anne: I think the whole story will be about Mrs. Mallard and how she feels about her husband’s death.
Pallavi: Maybe she is actually relieved by his death.
Ms. Gett: That is a good prediction. Based on the last three paragraphs, do we have any other predictions about what will happen next in the story?
Alex: I think Mrs. Mallard is going to die too because she has a heart condition.
Greg: She might be so heartbroken that she dies too.
Ms. Gett: Let’s see if these predictions occur in the story. We’ll read another section of the story now and see if these predictions happen. Be sure to think about more predictions as you read the next section.
Directed Reading Thinking Activity (DRTA)

Conservation of Energy

Many roller coasters have a mechanism that pulls the cars up to the top of the first hill, but the cars are on their own the rest of the ride. As the cars go up and down the hills on the track, their potential energy is converted into kinetic energy and back again. But the cars never return to the same height they started from. Does that mean the energy gets lost somewhere along the way? Nope—it just gets converted into other forms of energy.

Where Does the Energy Go?

In order to find out where a roller coaster’s original potential energy goes, you have to consider more than just the hills of the roller coaster. You have to consider friction too. Friction is a force that opposes motion between two surfaces that are touching. For the roller coaster to move, work must be done to overcome the friction between the cars’ and the surrounding air. The energy used to do this work comes from the original amount of potential energy that the cars have on the top of the first hill. The need to overcome friction affects the design of a roller coaster track. In figure 23, you can see the second hill will always be shorter than the first.

When energy is used to overcome friction, some of the energy is converted into thermal energy. Some of the cars’ potential energy is converted into thermal energy on the way down the first hill, and then some of their kinetic energy is converted into thermal energy on the way up the hill. So energy isn’t lost at all—it just undergoes a conversion.

6. Allow students to look at the title, graphics, subheadings, or even read the first part of the selected text. Ask students what they think the selection will be about.

7. Have the students read the selection and tell them to use their predictions as the purpose for their reading.

8. Once the students have finished reading the text, discuss what happened. Ask the students whether or not their predictions were found in the text. The students can discuss what they found in the text that surprised them, what confused them, or what information in the text selection supports their prediction.

Example discussion:
Teacher: Class, open your text books to page 229. Look at the page. Notice the pictures, the titles, etcetera. What do you think the reading is going to be about?

Anne: The title is conservation of energy, so maybe it’s about how we should not leave the lights on all the time and need to car pool.

Mike: That one title says “Where Does the Energy Go?” so maybe its about how different types of energy disappear.

Teacher: Those are both interesting ideas.

David: I think its going to be about roller coasters.

Teacher: What makes you think that?

David: Well, there is a huge picture of a roller coaster on the page.
Teacher: Yes, but what does a roller coaster have to do with energy?
David: Um, well, it takes energy to go up and down and around the loops.
Teacher: That’s a great point.
Kim: I think it is going to be about how a roller coaster stops. You know, what makes it stop.
Teacher: Well, why would you say that?
Kim: Friction is in bold, and I think friction is what makes things slow down, kind of like a sled at the bottom of a hill.
Teacher: You guys have come up with some interesting prediction. Let’s read silently and see if our predictions are found in the text.

After the class reads the text selection, the whole-class discussion begins again:

Teacher: So, after reading this page, what happened with your predictions?
David: Mine was pretty good. It was about roller coasters and how they move around.
Teacher: How does this say they move around?
David: Something about how the cars have to overcome friction between the wheels and the rails. They use energy to overcome friction and its converted into thermal energy, but I really didn’t understand that part.
Teacher: And Kim, you mentioned something about friction in your prediction. What did the text say about friction?
Kim: That a roller coaster uses energy to overcome friction between the cars and the rails.
Teacher: Great. Are there any questions?
Amanda: The text said that energy isn’t lost but is converted instead to thermal energy and other types. I don’t understand how that can happen. It seems like the energy is used up, so it shouldn’t exist anymore.
Teacher: That is a very interesting thought. How about we read the next section and we will discover what happens to this energy that Amanda is talking about.
Guided Reading Procedure

The Guided Reading Procedure (GRP) teaches students to monitor while they read by noting those ideas that they remember very well and those ideas that are confusing or that they have forgotten. It also emphasizes rereading, a good strategy for clarifying ideas while reading.

GRP Steps:

1. **Prepare students for reading.** Clarify key concepts; determine what students know and don’t know about the particular content of the book or chapter; build appropriate background knowledge.

2. **Assign a portion of the text to be read OR read aloud a portion of the text.** Read enough of the text so that students will have trouble remembering all of the ideas.

3. **After reading the portion of text, students will turn their books face down.**

4. **Students will note those ideas that they remember reading very well and those ideas that they have forgotten or the ideas that confused them.** Have students make two columns on a sheet of paper. Mark the left column “Ideas I Know.” Mark the right column “Fuzzies.” Teachers can also do this as a whole class activity by making the two columns on chart paper.

<table>
<thead>
<tr>
<th>Ideas I Know</th>
<th>Fuzzies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. **Redirect students into their books/chapters to reread the portion of the text and revise the ideas on their chart.** Students will reread to make sure that the ideas they knew were in the text. They will also revise their fuzzies.

6. **Read another portion of the text and repeat the procedure.**
Guided Reading Procedure

Tropisms

From Glencoe Biology ***cite***

Plants respond to stimuli such as light and gravity. Animals respond to stimuli because they have sense organs. How do plants respond to stimuli if they don’t have a nervous system? Some plant responses, such as flowering and movement towards light, are caused by changes in growth patterns of cells.

A tropism is a movement of a plant caused by a change in growth as a response to a stimulus. You may not have seen a tropism because most of the movements are so slow. When a root grows down or when a stem bends over, the plant is showing a tropism.

One tropism that is easy to recognize is phototropism. Phototropism is the growth of a plant in response to light. A plant showing phototropism bends toward the light. When leaf stalks bend toward the light, more light falls on the leaves…

Hormones play a role in tropisms. The growth hormone in a stem tip is affected by light. Light causes the growth hormone to move to the dark side of the stem where it causes the cells to lengthen… Because the cells on the dark side of the stem become longer, the stem bends toward the light…

Roots grow downward into the soil as a result of gravitropism. Gravi means having weight. Gravitropism is the response of a plant to gravity. As in the stem, the growth region of the root produces a growth hormone.

If you put a sprouting bean on its side on top of some potting soil, the root will grow downward into the soil within a few days. Large amounts of growth hormone in the root move through the cells to the lower side of the root, as if pulled down by their weight… This diffusion is in response to gravity. The hormone slows down the growth in length of the lower cells. The cells above continue to grow longer and the root grows down into the soil.

Grape vines, honeysuckle, and greenbriar are very common climbing plants in the forests of the United States. These climbing plants hold onto trees or fences by thigmotropism. Thigma means touch. Thigmatropism is a plant growth response to contact. Many climbing plants have twining parts called tendrils that respond to contact with a likely support by coiling around this object. The start of coiling can happen within ten minutes. Peas, beans, and squash are examples of food plants with tendrils that show thigmotropism.

1. Prepare the students for reading by building prior knowledge and clarifying concepts.
2. Read a portion of the text.
3. After reading a portion of the text, everyone turns their books down.
4. Have students make two columns on a sheet of paper (or provide them with a chart), labeling one column “Ideas I know” and the other “Fuzzies.” Have students fill in the chart (or do this as a whole class). Example:
Plants respond to light
Hormones move to dark side of stem and causes cells to lengthen
Tropism is when a plant responds to a stimulus and grows differently.
Roots grow downward because of gravity and this is called gravitropism.
If you put a bean on its side, its roots will still grow downward.

The name for a when a tropism responds to light
What it is called when a plan grows up the side of a building?
How do plants climb up things?
How do the hormones make beans grow down?

### Ideas I Know

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### Fuzzies

| The name for a when a tropism responds to light |
| What it is called when a plan grows up the side of a building? |
| How do plants climb up things? |
| How do the hormones make beans grow down? |

5. Have students reread the text and revise their fuzzies.

### Ideas I Know

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### Fuzzies

| The name for a when a tropism responds to light |
| What it is called when a plan grows up the side of a building? |
| How do plants climb up things? |
| How do the hormones make beans grow down? |

6. Read some more of the text and repeat the procedure.
Say Something

In small groups, students read the text and stop periodically. Students must say something about a prediction of theirs, a question, a comment, or connection. Each student must say something relating to the story using each type of comment. Here are some examples students can use to form their statements:

- **Prediction**
  - “I think that __________ will happen.”
  - “I predict that…”
- **Question**
  - “I wonder why…”
  - “I don’t understand…”
- **Comment**
  - “I liked __________ in the story.”
  - “I disliked __________ in the story.”
  - “One interesting part of the story was…”
- **Connection**
  - “This story reminds me of…”
  - “This story is like…”
  - “This character makes me think about…”

A good idea would be to provide students with a worksheet that has a table with columns labeled “Prediction,” “Question,” “Comment,” and “Connection.” Students can check off or write down their comments as they make them.

Here is an example of a “Say Something” activity for What Causes Changing Seasons? (used pp. 675 and 676 of Glencoe Earth Science)

**What causes Changing seasons?**
Flowers bloom as the days get warmer. The Sun appears higher in the sky, and daylight lasts longer. Spring seems like a fresh, new beginning. What causes these wonderful changes?

**Orbiting the Sun**
You learned earlier that Earth’s rotation causes day and night. Another important motion is revolution, which is Earth’s yearly orbit around the Sun. Just as the Moon is Earth’s satellite, Earth is a satellite of the Sun. If Earth’s orbit were a circle with the Sun at the center, Earth would maintain a constant distance from the Sun. However, this is not the case. Earth’s orbit is an ellipse (ee LIHPS)-and elongated, closed curve. The Sun is not at the center of the ellipse but is a little toward one end. Because of this, the distance between Earth and the Sun changes during Earth’s yearlong orbit. Earth gets closest to the Sun-about 147 million km away-around January 3. The farthest Earth gets from the Sun is about 152 million km away. This happens around July 4 each year.

Does this elliptical orbit cause seasonal temperatures on Earth? If it did, you would expect the warmest days to be in January. You know this isn’t the case in the northern hemisphere, something else must cause the change.
Even though Earth is closest to the Sun in January, the change in the distance is small. Earth is exposed to almost the same amount of Sun all year. But the amount of solar energy any one place on Earth receives varies greatly during the year. Next, you will learn why.

Jimmy: I predict that the Earth gets different amounts of solar energy because isn’t the Earth tilted? (Prediction)

Holly: I think this reminds me of what we talked about a while ago with the Earth’s rotation (Connection). I remember the Earth is on an axis and it rotates, but the axis is slanted, so I agree with you. I think the axis could have something to do with the solar energy.

A Tilted Axis

Earth’s axis is tilted 23.5 degrees from a line drawn perpendicular to the plane of its orbit. It is this tilt that causes seasons. Daylight hours are longer for the hemisphere, or half of Earth, that is tilted toward the Sun. Think of how early it gets dark in the winter compared to the summer. As shown in Figure 3, the hemisphere that is tilted toward the Sun receives more hours of sunlight each day than the hemisphere that is tilted away from the Sun. The longer period of sunlight is one reason summer is warmer than winter, but it is not the only reason.

Holly: I don’t understand if the axis moves or is stationary? Does the Earth just spin around the axis? (Question)

Jimmy: You know what I like in the section? I think it is cool how the hemispheres have more daylight than others because they face the sun (Comment). It reminds me of how in the fall when I play soccer, in August we start games at around 6 finish at 7 and its still light outside, but later in the fall around November, we start at 6 and its already getting dark! (Connection)

Holly: That’s true! It says that the long period of sunlight isn’t the only reason summer is warmer than winter. I predict that the other reason has something to do with UV rays because in the summer, the weatherman always talks about how they’re really bad around lunch time. You never hear about UV in the winter, do you? (Prediction and Connection)

Jimmy: Oh, I never thought about that. Lets what happens…

Radiation from the Sun

Earth’s tilt also causes the Sun’s radiation to strike the hemispheres at different angles. The hemisphere tilted toward the Sun receives more direct rays, thus more total solar radiation than the hemisphere tilted away from the Sun. In the hemisphere tilted away from the Sun, the Sun appears low in the sky, and its rays are slanted.

Summer occurs in the hemisphere tilted toward the Sun, where the Sun appears high in the sky. Its radiation strikes Earth at a higher angle and for longer periods of time. The hemisphere receiving less radiation experiences winter.

Jimmy: I think it’s interesting how the book talks about in the winter time the Sun is low in the sky (Comment).

Holly: I guess that is like in the summer, when I’m out at the pool the Sun is directly straight up above (Connection). I think it is interesting how the angle of the sun changes so much because 23.5 degrees doesn’t seem like that much of a tilt (Comment).

Jimmy: You know, about your prediction earlier, it didn’t say anything
about UV rays. It seems like that is still a good prediction though. I think we should ask Mrs. Moore about that. Also, I wonder why receiving direct rays makes the Earth have more solar radiation. I just do not understand that (Clarify).

Mrs. Moore: Did you say you had a question?
Jimmy: Yes, we were wondering why the Earth gets more solar radiation because it receives direct rays. It really doesn’t explain it well. If you think about it, the same amount of rays is still hitting Earth no matter what angle.

Mrs. Moore: That’s a great question guys. One of the reasons is the Earth’s atmosphere. Remember a while back we talked about how the sun passes through the Earth’s atmosphere, some radiation is absorbed, some passes through, some is reflected back, etc. Also, remember how the atmosphere is thicker in the lowest layers of the atmosphere?

Holly: Yeah, more pressure or something?
Mrs. Moore: Yes, now I want you to take that and connect that with the angle of the Sun. In the winter, the Sun is closer to the horizon. Think about that for a few minutes, and I want to bring that up when we discuss what we have read as a whole class.