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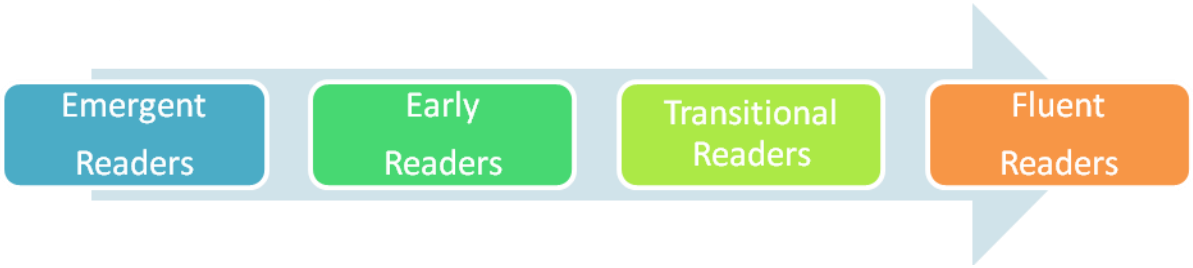
Reading and Language Arts: Curriculum, Instruction, and Assessment

Reading Foundational Skills

Developmental Stages of Reading

The developmental reading continuum is used to describe the progressive stages in which students develop both fluency and comprehension skills over time based on reading experiences. The reading levels are typically classified according to the four primary developmental stages below:



The chart below describes key instructional emphases for each stage:

Stage	Instructional Emphasis
Emergent Readers	Concepts of print Recognizing/predicting language patterns
Early Readers	High frequency words Use of cueing systems Phonological awareness Reading for meaning
Transitional Readers	Literary elements Higher order comprehension Fluency and self monitoring Vocabulary
Fluent Readers	Independent text selection/reading Increased text complexity and analysis Multiple genres, including hybrids Reading to understand social issues

TEST TIP

- It is important to remember when planning instruction that reading is a developmental progression of skills based primarily on reading experience, not necssarily age or grade.

Concepts of Print

Early literacy skills include the knowledge of book handling skills and print awareness, collectively known as ***concepts of print***. The chart below outlines instructional strategies for teaching concepts of print.

Concepts of Print	Instructional Strategies
Directionality	Shared/Interactive Writing (e.g., morning message, class news)
Return Sweep	Shared/Interactive Reading (e.g., chants and poems)
Book Orientation	Modeled Reading (e.g., big books, picture books)
Basic Punctuation	Modeled Writing (e.g., Writing Workshop mini-lesson)
Letters and Words	Word Work (e.g., word walls, charts, sorts)
Print conveys meaning	Guided Reading (e.g., skill-based strategy groups)

Phonological Awareness

Phonological awareness describes the awareness of words, rhymes, syllables, onset and rime, as well as individual sounds (or phonemes).

Components of Phonological Awareness:

Onset and Rime Awareness

- Hearing and segmenting onsets and rimes
- Blending onsets and rimes

Phonemic Awareness

- Phoneme segmentation
- Phoneme isolation
- Phoneme blending
- Phoneme addition/deletion
- Phoneme manipulation, reversal, substitution

Rhyme Awareness

- Recognizing and producing rhyming words

Syllable Awareness

- Recognizing syllables
- Segmenting syllables
- Blending syllables

Word Awareness

- Recognizing word boundaries
- Segmenting sentences into words
- Understanding that words have meaning

TEST TIP

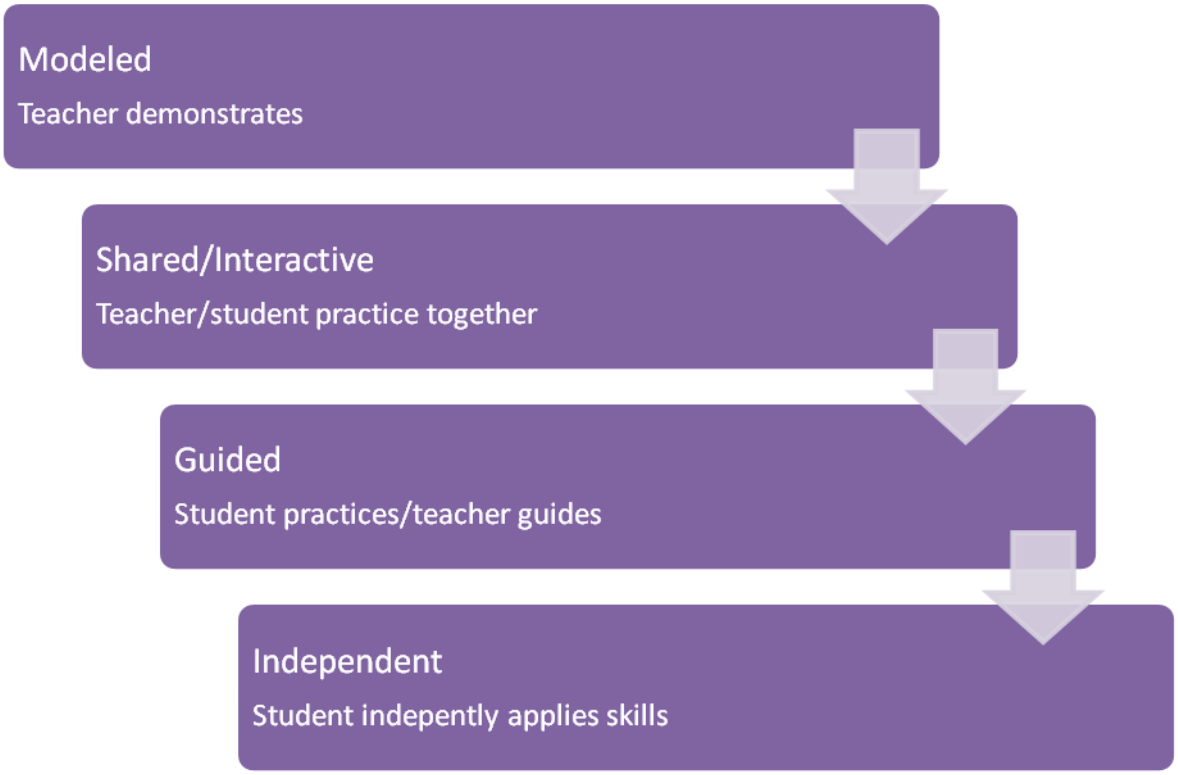
- Note that phonological awareness involves the knowledge of sounds only, whereas phonics involves the knowledge of both sounds and printed letters working in conjunction.

Strategies for Teaching Phonological Awareness:

The table below identifies effective instructional strategies for teaching each component of phonological awareness. Note that while not repeated across categories, several strategies may nevertheless be appropriately adapted to target more than one skill.

PHONOLOGICAL COMPONENT	INSTRUCTIONAL STRATEGIES	
Onset/Rime Awareness	Oral blending and segmentation	Push-n-Say (flip books, word wheels, slides)
	Picture sorting	Oral cloze activities
Phonemic Awareness	Name games	Multisensory mapping
	Sound substitution songs/chants	Elkonin boxes/ Sound tokens
Rhyme Awareness	Complete missing rhymes in read aloud	Sorting examples/ non-examples
	Picture matching	Generate rhymes to a given example
Syllable Awareness	Clapping games	Jumping syllables
	Counting tokens	Syllable sorts (pictures, objects)
Word Awareness	Replace key words in songs	Count words in a sentence using interlocking cubes
	Signify words in a sentence using dot markers	Graph words while listening to recorded sentences

The use of instructional strategies in literacy should follow the ***gradual release of responsibility*** model, in which the teacher first models target skills followed by gradual, strategic transfer of responsibility to increase student autonomy. The diagram on the next page illustrates this model.



Decoding

Both **phonics** and **word analysis** skills directly contribute to a student's ability to decode unfamiliar words.

- Systematic ***phonics*** instruction teaches students the relationship between individual spoken sounds *(phonemes)* and written letters *(graphemes)*.
- ***Word analysis*** refers to the ability to use knowledge of both spelling and meaning to decode text. This includes the use of root words, suffixes and prefixes.

TEST TIP

- The use of roots and affixes to predict the meaning of words is also known as *morphology*.

Instructional Strategies to Support Decoding:

PHONICS	WORD ANALYSIS
• Magnetic/tile word building • Word/letter Sorts • Word building as part of guided reading lessons • High frequency words • Sight words • Personal word rings • Word walls • Speed drills • Phonetic word cards • Walk and read charts • Spelling songs • Letter books • Word study notebooks • Self-monitoring and correction strategies • Alphabetic arcs	• Charting word patterns found in content area vocabulary *(e.g. **quad**rilateral, **quad**rangle)* • Student-created glossaries based on high-interest texts • Vocabulary games • Affix word sorts • Illustrated root word notebooks • Strategic word searches • Brainstorming root word derivatives • Semantic maps • Mix and matching parts of compound words • Class book of homograph, homophone, and homonym pairs

Cueing Systems for Decoding:

Successful readers use three primary cueing systems to decode:

- ***Graphophonic*** – visual
- ***Semantic*** – contextual
- ***Syntactic*** - structural

These cueing systems combined enable students to successfully decode and comprehend text. The table on the next page identifies instructional strategies and prompts for each cueing system.

CUEING SYSTEM	PROMPT	INSTRUCTIONAL STRATEGIES
Graphophonemic	Does it look right?	• Word Sorts • Word Families • Word Building
Syntactic	Does it sound right?	• Cut up sentence building • Guess the covered word • Reading ahead • Re-reading
Semantic	Does it make sense?	• Activating prior knowledge • Anticipation sets • Predict & confirm • Picture walks

Fluency

Fluency is the ability to decode text quickly and accurately, with appropriate phrasing and expression. Automaticity is progressively developed at the letter, word, and text levels. Fluent readers are thus able to focus on text comprehension rather than decoding. They automatically connect sound symbols to concepts and more readily construct meaning from text. Students need to develop both silent and oral reading fluency in order to be successful readers.

Instructional strategies to develop fluency include:

- Modeled fluent reading
- Choral reading
- Echo reading
- Guided oral reading
- Fluency strips
- Reader's theatre
- Poetry reading
- Nonsense word reading
- Timed repeated readings
- Prosody sets •
  Alphabetic arcs •
  Phrase cued text •
  Cloze reading •
  Partner reading
- Selecting appropriate leveled, decodable texts

Reading Literature & Informational Texts

Reading Comprehension Strategies

Reading comprehension is the ability to understand and respond to text. Best practices that promote reading comprehension include:

- Explicit strategy instruction
- Meta-cognitive modeling (think aloud)
- Integrated instruction of graphics, print and digital media
- Extended time for students to engage in independent reading
- Dialogue between students and teachers, as well as students and peers, about texts
- Providing guided student choice in selecting leveled texts
- Collaborative learning
- Frequent feedback

Successful readers are strategic readers. Like other reading skills, comprehension strategies should be explicitly taught, modeled, guided, and transferred to students following the gradual release of responsibility model. Key reading comprehension strategies include:

1. ***Predict*** – anticipate what will happen next
2. ***Determine Importance*** – identify main idea and supporting details
3. ***Question*** – generate and respond to questions about text
4. ***Make Connections*** – relate text-self, text-world, text-text
5. ***Infer*** – identify implicit meaning
6. ***Synthesize*** – merge new and prior knowledge

Teachers must be skilled in selecting appropriate instructional strategies that support reading in both fiction and non-fiction texts. The

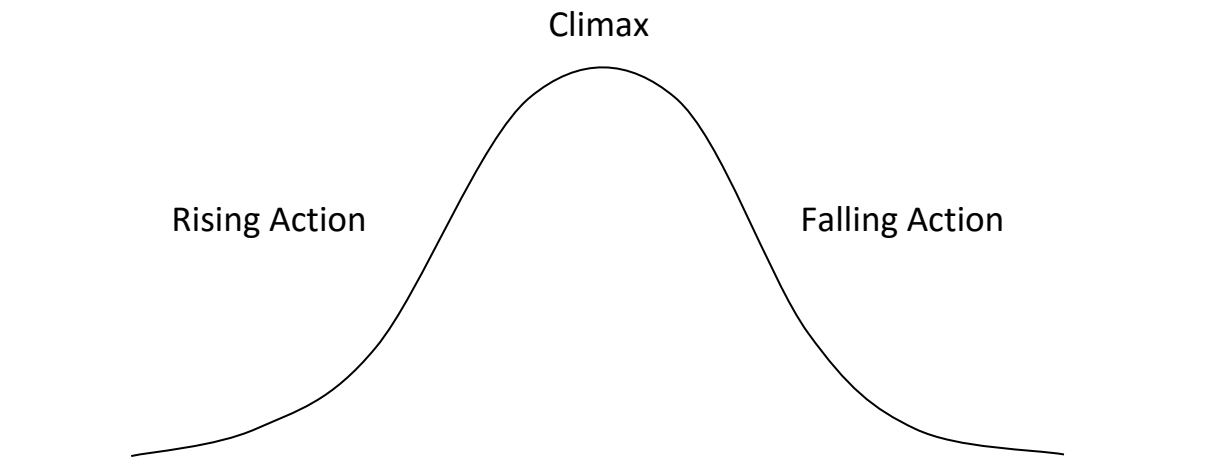
following pages outline effective instructional practices for developing each of the six major reading comprehension strategies listed above.

1. Predicting

Predicting makes use of students' prior knowledge in order to inform their understanding of text. Successful readers are able to anticipate what will happen next in a narrative arc or expository process. Instructional strategies to teach prediction include:

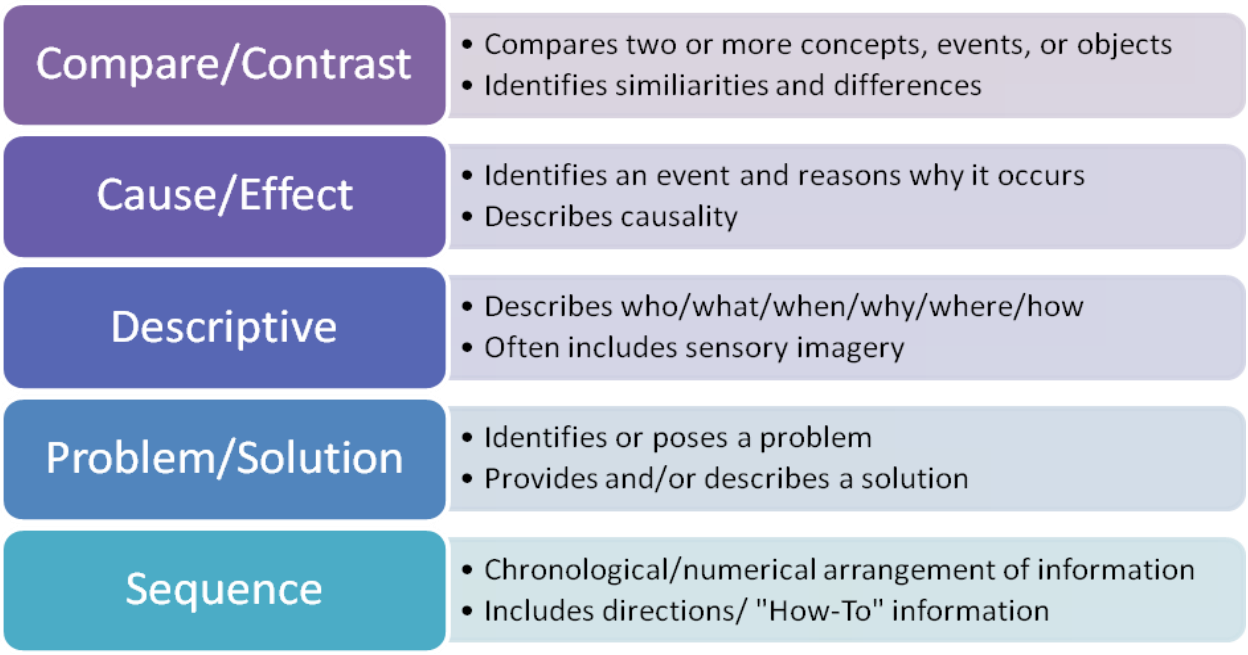
- Previewing/text feature walk
- Skimming for key words
- Anticipation guides
- Semantic features analysis
- Narrative story maps
- Highlighting signal words
- DRTA (Directed Reading Thinking Activity)
- Analyzing expository text features

Familiarity with the structure of texts helps students make informed predictions. The following diagrams outline narrative and expository text structures:



Narrative Text Structure

Expository Text Structures



Signal words are words used to signify relationships between and within texts. Close attention to signal words, combined with knowledge of text structure, can help students make predictions and text connections while reading. The following table pairs signal words with the relationship/connection they signify when reading or responding to text:

Relationship	Signal Words
Comparison	than, like, as, likewise
Contrast	however, unlike, but, nevertheless, rather, instead, despite, regardless
Causality	therefore, because, if, since, so, hence, consequently, as a result, thus
Sequential	previously, next, then, afterwards, meanwhile, finally, eventually
Descriptive	for example, for instance, additionally, including, specifically

Expository text features are informational components of writing that are separate from the main body of text.

Examples of Expository Text Features		
Glossary	Guide Words	Title
Table of Contents	Labels	Subtitle
Index	Headings	Photographs
Text Box	Subheadings	Illustrations
Charts	Tables	Graphs
Maps	Diagrams	Captions

2. Determining Importance

Successful readers are able to identify and distinguish between main and ideas and relevant supporting details. Strategies to teach determining importance include:

- Sorting necessary/unnecessary information
- Shared editing of contrived text
- Using retelling ropes with a partner
- Constructing narrative timelines
- Graphic clustering
- Two-column notebooking (main idea/supporting details)

3. Questioning

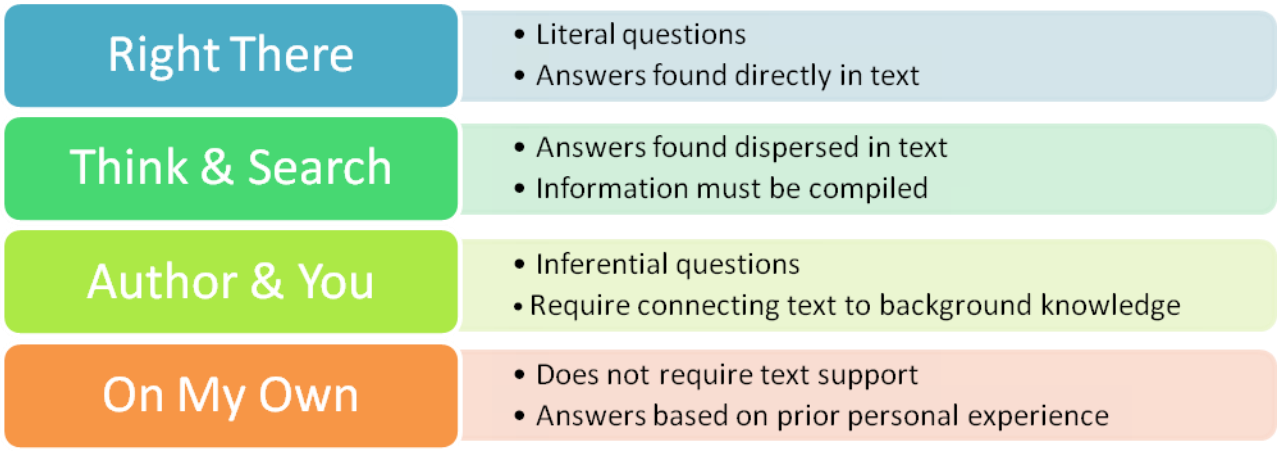
Students who can both respond to and generate questions about text demonstrate higher levels of reading comprehension. Questions not only provide a purpose for reading, but also better enable students to focus on key information, self-monitor comprehension, and synthesize new information with what they already know.

Instructional strategies for teaching questioning include:

- Question frames
- Question webs
- Text annotation
- Think-aloud
- QAR sorts/charts

QAR (Question-Answer Relationship) is a fundamental strategy that helps students understand different types of questions and what information they must consider prior to constructing a response. Students should have opportunities to practice classifying, responding to, and generating all types of questions.

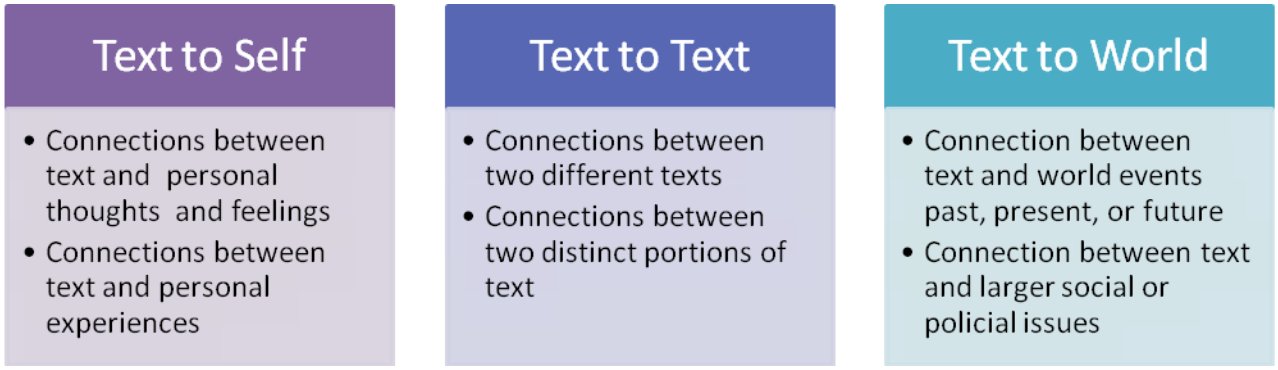
The four types of questions include:



4. Making Connections

Successful readers construct meaning by reflecting on and responding to what they've read, making connections between new information and prior thoughts and experiences.

Text connections include:



Instructional strategies that help teach students how to make connections include:

- Double entry response journals
- Grand conversations
- KWL charts
- Venn diagrams
- Connection mapping

5. Inferring

Inferring is the ability to make an educated "guess," or implicit conclusion, based on the evidence presented within a text. Instructional strategies that help students how to infer include:

- Evidence logs
- Flagging textual support •
  Character analysis grids •
  Fables (infer the moral) •
  Analyzing time capsules •
  Reading wordless picture books
- Solving visual puns
- Analyzing political cartoons

6. Synthesizing

Synthesizing occurs when readers merge information from text with prior knowledge. They determine if new ideas confirm or challenge their original way of thinking and adjust concepts accordingly. Strategic readers constantly re-evaluate schema as they progress through a text.

Instructional strategies that help teach synthesis include:

- Using mentor texts
- Creating process charts to map concept evolution
- Re-writing text to demonstrate author bias/point of view
- Paraphrasing essential concepts of lengthier texts
- Running evidence chart to determine author's purpose
- Constructing a comparison matrix

When more advanced readers synthesize information, they are also often required to differentiate between:

Instructional strategies that support this skill include:

- Color coding text
- Paired paragraphs/images
- Constructing comparison matrices

- Debates
- Mock trials
- Analyzing primary source materials
- Compare/contrast primary and secondary source materials

TEST TIP

- Remember, primary sources are not limited to printed text, but can include audio, visual, and electronic media as well as creative works and artifacts.

Synthesizing also includes the ability to compare and integrate information from a variety of sources, including visual, oral, and written information in addition to multimedia sources. Synthesis strategies can be adapted and applied across media formats as well as content areas.

Instructional Strategies for Teaching Text Selection

Successful readers select texts appropriate for their reading level. ***Reading levels*** (also referred to as readability levels) denote how well a student is able to both accurately decode and comprehend text. The same text may represent a different level for different children based on their personal reading development profiles.

The chart on the following page lists and describes each of the three basic reading levels, including the minimum accuracy rate at which students must read at each level.

Reading Level	Rate of Accuracy	Characteristics
Frustrational	Less than 90%	• Text is too difficult for the reader. • Reader cannot quickly a/o accurately decode text; may not possess adequate schema for comprehension. • Requires extensive teacher assistance.
Instructional	90 - 94%	• Text is appropriately challenging, but not too hard. • Reader can decode text quickly and accurately while comprehending meaning. • Benefits from some teacher support.
Independent	At least 95%	• Text is easy for the reader. • Reader can quickly decode and comprehend text without errors. • Does not require teacher support.

It is important that students learn to self-select books that are appropriate for their reading level, interest, and purpose in order to avoid both frustration as well as stagnation in their reading development. As with other reading skills, self-selection of appropriate texts should be explicitly taught and then transferred to students under the gradual release of responsibility model.

Instructional strategies to teach appropriate text selection include:

- Modeling/think-aloud questioning
- Questioning anchor charts

- Five finger fluency/Goldilocks rules for "just right" texts
- Targeted student-teacher conferences
- Book talks

Questions Strategic Readers Ask When Selecting Texts

- What is my purpose? (literary experience or obtain/use information)
- What interests me?
- Can I read the words accurately?
- Can I read the words quickly?
- Do I understand it?
- Is it too easy, too hard, or just right?

Maintaining a well-organized and accessible classroom library that encompasses a wide range of text levels and genres also fosters student independence in selecting appropriate titles.

Promoting Higher Levels of Thinking

Quality literacy instruction follows a coordinated instructional sequence and equips students to demonstrate reading comprehension skills at all levels of Bloom's taxonomy.

The table on the following page lists the levels of Bloom's Taxonomy is order of increasing complexity, defines them, and provides examples of key tasks associated with each cognitive level within the heirarchy.

Cognitive Level	Definition	Tasks
Knowledge	Recalling information	Define Identify List Describe
Comprehension	Understanding new information	Explain Summarize Paraphrase Discuss
Application	Using new information in a novel context	Construct Demonstrate Solve Produce
Analysis	Identifying parts of concepts and interrelationships	Categorize Compare Contrast Differentiate
Synthesis	Integrating concepts to create new ideas	Formulate Create Develop Hypothesize
Evaluation	Assessing information and making judgments	Justify Support Critique Conclude

TEST TIP

- Bloom's Taxonomy is not exclusive to Reading and Language Arts. Instructional objectives across all content areas should be developed with this hierarchy in mind.

Text complexity bands (often described in terms of Lexile measures) signify the readability of text according to 3 major components:

1. ***Quantitative Measure:*** used to assign a grade level band
2. ***Qualitative Measure***: used to help teachers evaluate the conceptual complexity of a text
3. ***Reader and Task Considerations***: inform teachers' professional judgment when pairing readers with text

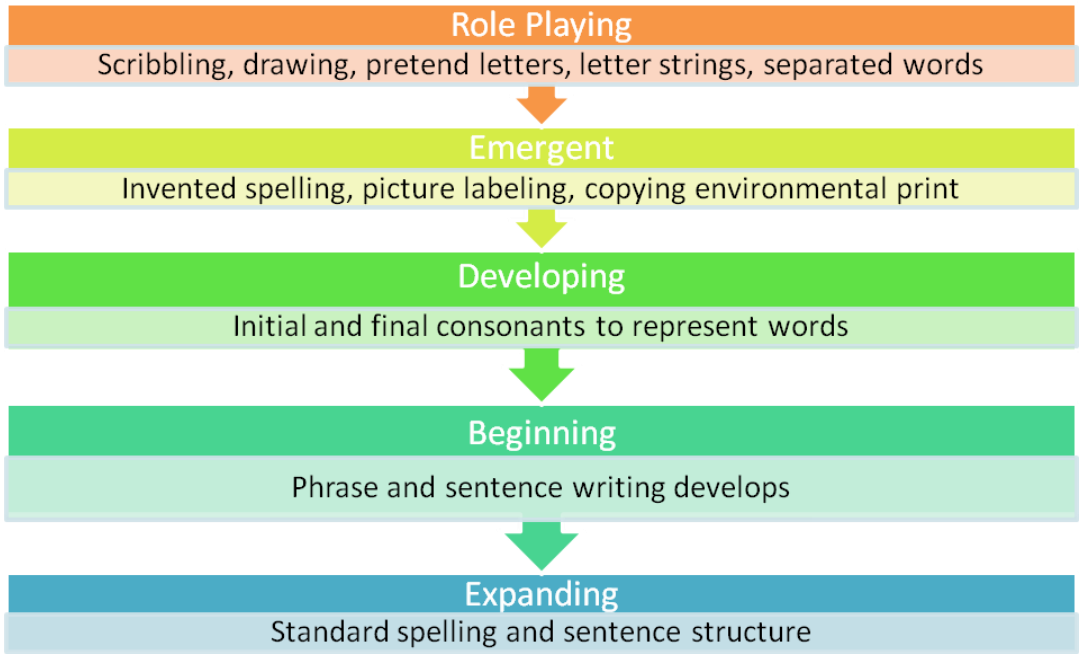
Quality, scaffolded reading instruction will stretch students to read an increasing volume of texts at the high end of their text-complexity band over the course of time. It is important for teachers to follow the gradual release of responsibility model in order to provide appropriate levels of support as readers progress. Strategies for supporting student progress toward independent proficient reading at this level include:

- Frontloading schema
- Explicit vocabulary instruction (academic and content area terms)
- Close reading (including annotation and repeated readings)
- Developing purpose statements
- Purposeful grouping
- Collaborative conversations
- Reciprocal teaching
- Supplying accessible grade-level texts

Writing

Stages of Writing Development

As with reading, students develop writing skills in progressive stages.



Effective writing instruction is scaffolded to support students at each stage of writing, following the gradual release of responsibility model. The chart below outlines developmentally appropriate instructional strategies to support writers along this continuum.

Modeled Writing	• Teacher strategically models specific writing skills • Teacher models metacognitive writing processes
Shared Writing	• Teacher and students share writing • Students generate ideas; teachers help apply craft
Guided Writing	• Students apply stratregies with teacher support • Utilizes authentic writing tasks
Independent Writing	• Students independently apply writing strategies • Incorporate skills into publication process

Another important skill for the study of history is an understanding of cause and effect relationships. The chart below shows an example of a cause and effect relationship in American history that students may study at the elementary level.

Tips for Teaching Cause and Effect

- Make a habit of asking "Why?" and encouraging students to do the same.
- Use graphic organizers such as timelines, flowcharts, and feedback loops .
- Guide students to think of events as having multiple causes and consequences.

The ability to compare and contrast is useful in the study of history as students compare the past to the present and different cultures and time periods to one another. Graphic organizers such as Venn diagrams can help students to organize information and draw conclusions.

Taken together, all of these skills help students to be able to analyze historical events and make connections between the past and the present. When students are able to draw comparisons between their own experiences and those they learn about in history, learning becomes more deep and meaningful.

United States History

The history of the United States is an area of primary focus in the elementary social studies classroom. Major topics of study include:

Topic	Key Areas of Focus	
Native American Cultures	• Major tribes in each region	• Cultures, governments, and relations
European Settlement	• Motives for exploration • Colony system	• Major settlements (e.g., Plymouth, Jamestown)
The American Revolution	• Causes of the revolution • Declaration of Independence • U.S. Constitution	• Major leaders and battles • Establishing a new nation • Articles of Confederation
Territorial Expansion	• Manifest Destiny • Railroads	• Relations with Native Americans
The Civil War	• Sectionalism • Slavery • Abolitionism • 13th, 14th, and 15th Amendments	• Major leaders and battles • Emancipation Proclamation • Reconstruction
Industrialization	• Industrial Revolution • Factory system • Urbanization	• Key inventors/inventions • Labor conditions and reform
20th Century Conflicts	• World War I • World War II • Cold War	• Korean War • Vietnam War • Gulf War
20th Century Developments	• The Great Depression • Civil Rights Movement	• Women's Rights Movement

World History

At the elementary level, studies of world history primarily focus on early river valley and classical civilizations. The earliest civilizations emerged in river valleys. The study of these cultures should emphasize

the role of geography, since access to water provided fertile land, a means of transportation, and trade. Two of the major river valley civilizations are listed in the chart below.

Civilization	Key Ideas
Mesopotamia (Tigris and Euphrates Rivers)	• *Polytheism* (belief in many gods) • Created *ziggurats* (step-pyramids) • Sumer- first writing system (*cuneiform*) • Babylon- first written law code (*Code of Hammurabi*)
Egypt (Nile River)	• Polytheism • Built pyramids as tombs for kings called *pharaohs* • Writing system called *hieroglyphics* written on *papyrus*

These early river valley civilizations eventually gave way to larger, more organized societies that became known as classical civilizations. These societies had an enormous lasting impact on our modern world. The chart below lists a few of the major classical civilizations and their contributions.

Civilization	Key Ideas
Greece	• Organized into *city-states* • *Direct democracy* (used in Athens) • Advancements in science, math, architecture, and the arts
Rome	• Two eras- Republic and Empire • Powerful, highly organized and trained military • *Twelve Tables* (law code) • Cultural diffusion across a vast empire • Engineering (extensive road network, aqueducts)
China	• Operated under the *dynastic cycle*- rulers believed to hold the "mandate of heaven" (divine right to rule) • Large bureaucracy that used a civil service system • Belief systems: Confucianism, Taoism, Legalism
India	• Belief systems- Hinduism, Buddhism, Jainism • Rigid social classes (*caste system*)

Government, Civics, and Economics

The Structure and Functions of Government

As students begin to learn about various governments—their own and those around the world—it is important that they start with a foundational understanding of the purposes and functions of government. Though governments can take many different forms, at their core, most governments are responsible for several basic functions:

Additionally, there are several basic structures that most governments contain. These may vary in form, but most governments are made up of the same basic elements, including a legislative body, a justice system, an executive, and a bureaucracy.

The Government of the United States

It is important for students to have an understanding of the principles, structures, and functions of their own governments in the United States. In order to engage as active citizens of the country, they must have a strong foundational understanding of how the country operates at a national, state, and local level.

The United States is considered a democratic republic, whose basic structure and functions are laid out in the United States Constitution.

The Constitution provides a framework for the government and is based on several basic principles, listed in the chart below.

Principle	Definition	Role in the Constitution	Instructional Strategies
Popular Sovereignty	Rule by the people	People have the right to vote for their leaders and to petition the government	Hold mock elections in the classroom
Federalism	Power is divided between national and state governments	*Delegated powers* are held by the federal government only; *reserved powers* belong to the states only; *concurrent powers* are shared	Use a graphic organizer such as a Venn diagram to show delegated, reserved, and concurrent powers
Separation of Powers	Power must be divided to prevent corruption	The federal government is divided into three branches (legislative, executive, and judicial)	Use a tree diagram to show the three branches of government
Checks and Balances	The branches of government should limit one another's power	Each branch has specific ways of checking the power of the other two	Use visual aids such as a balance scale (or diagram of one) to show how the branches' powers balance one another
Individual Rights	People have natural rights that the government must protect	The Bill of Rights and other amendments protect rights	Have students examine cases of rights violations
Flexibility	The Constitution must adapt to changing needs	The amendment process allows changes to the Constitution; the "elastic clause" grants legislative flexibility	Discuss why rules sometimes must change over time; relate to their own lives

Students should be familiar with the role of each of the three branches of the federal government.

	Executive Branch	Legislative Branch	Judicial Branch
Main Members	President	Congress, made up of Senate and House of Representatives	Supreme Court
Role	Enforces the law	Makes the law	Interprets the law
Important Powers	Head of state and head of government; signs bills into law; Commander-in-Chief of armed forces; directs foreign policy	Makes laws; makes official declaration of war; ratifies treaties	Interpreting the Constitution; judicial review (determining the constitutionality of laws- power granted in *Marbury v. Madison*); highest court of appeals
Method of Selection	Elected every 4 years (max. of 2 terms); popular vote influences final vote by Electoral College	Senate: 2 senators from each state elected every 6 years House: elected every 2 years; # of representatives for each state based on population	Appointed by the president (subject to Senate approval); serve for life
Checks on Executive Branch		Can impeach and remove president for crimes; can override presidential veto with 2/3 vote of both houses	Can declare presidential actions unconstitutional
Checks on Legislative Branch	Can choose to sign or veto bills		Can strike down laws as unconstitutional
Checks on Judicial Branch	Appoints justices	Approves judicial nominees; can impeach justices	

mathematical abilities develop, they gradually become more capable of working with increasingly abstract models. The following chart outlines the four basic levels of mathematical modeling:

Model	Description
Concrete Model	Uses physical objects to perform mathematical operations
Semi-Concrete Model	Uses pictures of objects (rather than the physical objects, as in the concrete model) to illustrate numbers when performing mathematical operations
Semi-Abstract Model	Uses symbols (e.g., tally marks) to represent numbers of objects when performing operations
Abstract Model	Using only numbers and variables to perform operations

The operations are typically learned in the following order: addition, subtraction, multiplication, division. The following pages outline some strategies for teaching the basic principles of these operations to children.

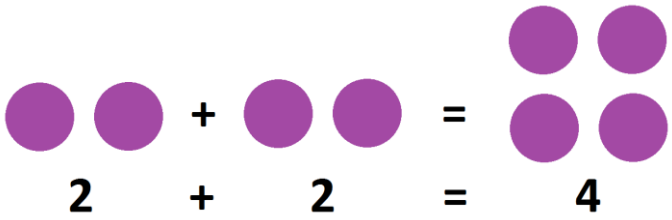
1. Addition

Early addition includes the ability to "count on," thereby adding additional objects to a starting quantity.

Example: Jack is counting stars. He counts 3 stars aloud: "1, 2, 3."

Jack's teacher then adds two more stars to the end of the row. If Jack has the ability to "count on," he can keep going and name the next two stars "4" and "5" (for a total of 5 stars). If Jack had not yet mastered this, he might call them "1" and "2" or start the counting process all over again to find the total number of stars.

Counting on is a fundamental skill on which the idea of addition is built. After mastering this, students can begin to move on to more complex addition tasks, such as adding groups of objects and adding using numerical representations.



Other strategies for addition include:

- Referring back to skip counting as repeated addition
- Using manipulatives to model operations
- Adding using a number line
- Using carrying to add multi-digit numbers
- Using strategies to improve mental math, such as adding by making groups of ten; this is especially helpful for working with large numbers
  Example: One way to solve 7 + 5 is to think in terms of making ten and then adding on the leftovers:
  7 + 5 = 7 + 3 + 2 = 10 + 2 = 12

2. Subtraction

Since subtraction is the inverse of addition, many of the strategies commonly used to teach subtraction are very similar to those used with

addition. Early on, manipulatives are important, as students can see subtraction as physically "taking away" a quantity.

Some additional strategies for subtraction include:

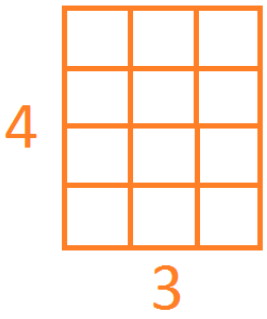
- Counting down
- Subtracting using a number line
- Using regrouping to subtract from multi-digit numbers
- Using strategies to improve mental math, such as subtracting using groups of 10, which is especially helpful when working with large numbers
  Example: One way to solve 38 - 12 is to think in terms of groups of ten:
  38 – 12 = 38 – 10 – 2 = 28 – 2 = 26

3. Multiplication

As a concept, multiplication is often taught as repeated addition. Students can start out by counting the objects in equal groups of things, and then eventually come to understand that they can make this calculation faster through multiplication.

One common visual tool used for multiplication is an array. An ***array*** is a visual representation that uses equal columns and rows to show how the two factors in a multiplication problem result in a given total (product).

The array at right shows 4 x 3 = 12. Beginning students can count all of the squares to get a total of 12. Eventually, as students become more comfortable with multiplication, they will memorize these basic facts and be able to perform the calculation without counting. Arrays help students to visualize problems and understand what



multiplication actually means. Arrays are also useful in geometry for learning to calculate area.

Additional strategies for multiplication include:

- Using manipulatives to model operations
- Using skip counting
- Teaching basic multiplication facts as "fact families" and using specific strategies for different families, such as doubling (2s), double plus one set (3s), and double-doubling (4s)
- Teaching strategies to improve mental math such as partial products (expanded form multiplication), in which numbers are broken down into easier to work with parts
  Example: 23 x 5 might be difficult to mentally compute, but by breaking 23 down into numbers that are easy to multiply, it becomes a simpler problem.
  23 x 5 = (20 + 3) x 5 = (20 x 5) + (3 x 5) = 100 + 15 = 115

4. Division

Like the other operations, division is best introduced visually. Manipulatives can be split into groups so that division is thought of as:

- "How many groups of _____ each can be made from _____?" (***measurement*** or ***grouping division***)
- "If I split a total of _____ into _____ groups, how many will be in each group?" (***partitive*** or ***sharing division***).

Other strategies for division include:

- Reverse multiplication
- Repeated subtraction
- Long division

- Using mental math strategies such as partial quotients, in the dividend and/or divisor are broken into parts that are easier to work with
  Example: 78 ÷ 6
  6 x 10 = 60 (close to 78 and easy to calculate mentally)
  78 – 60 = 18
  18 ÷ 6 = 3
  10 + 3 = 13
  78 ÷ 6 = 13

Properties and Order of Operations

There are three basic properties that govern operations—the Associative Property, the Commutative Property, and the Distributive Property. Knowledge of these properties can help students to solve more complex math problems.

Associative Property

- Works for addition and multiplication
- If the operations are all the same, you can regroup.
- Addition:
  $(a + b) + c = a + (b + c)$
  $(1 + 2) + 3 = 1 + (2 + 3)$
  $3 + 3 = 1 + 5$
  $6 = 6$
- Multiplication:
  $(ab)c = a(bc)$
  $(1 \cdot 2) \cdot 3 = 1 \cdot (2 \cdot 3)$
  $2 \cdot 3 = 1 \cdot 6$
  $6 = 6$

Commutative Property

- Works for addition and multiplication
- You can change the order of the addends in an addition problem or the factors in a multiplication problem without affecting the result.
- Addition:
  $a + b = b + a$
  $1 + 2 = 2 + 1$
  $3 = 3$
- Multiplication
  $a \cdot b = b \cdot a$
  $2 \cdot 3 = 3 \cdot 2$
  $6 = 6$

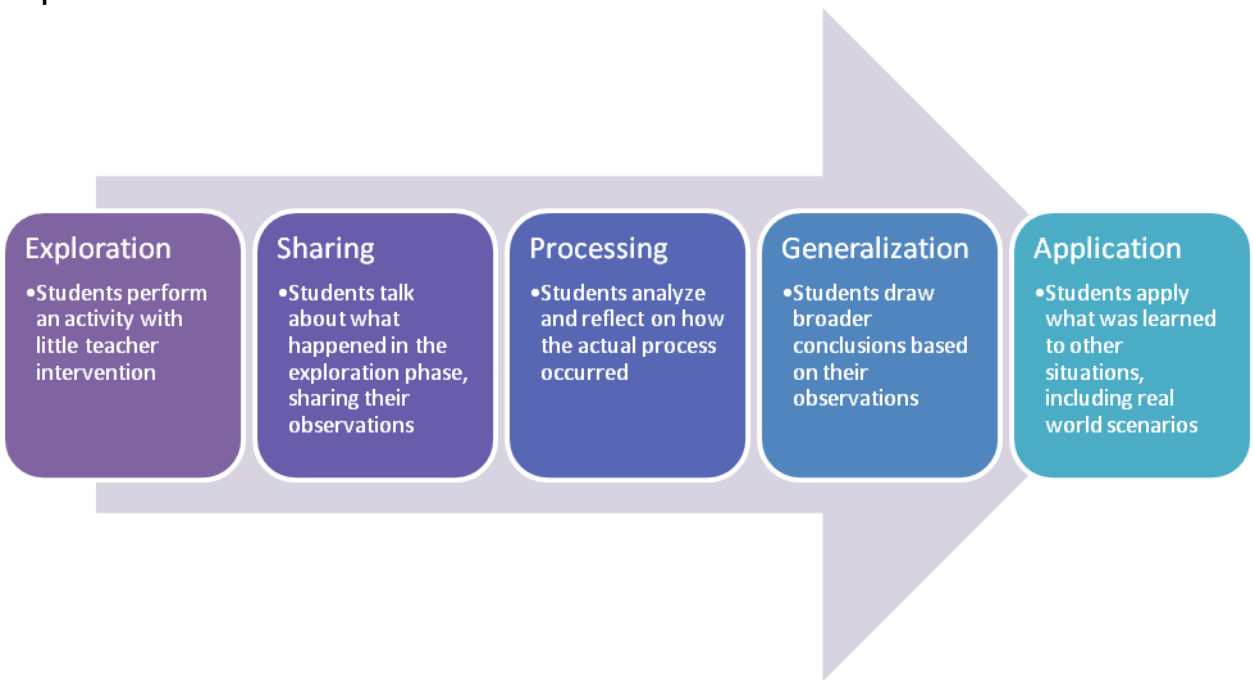
Distributive Property

- Works for multiplication
- When a number appears in front of parentheses (indicating multiplication), you can solve by multiplying by each number within the parentheses and adding the results.
- $a(b + c) = ab + ac$
  $2(-1 + 3) = (2 \cdot -1) + (2 \cdot 3)$
  $2(2) = -2 + 6$
  $4 = 4$

concepts. There will be times when direct instruction is appropriate, but often, more student-centered approaches will lead to more active student engagement and meaningful learning. Some of the instructional formats that work well in science include:

- Laboratory experiments
- Observation
- Exploration of the natural world (nature walks, etc.)
- Hands-on demonstrations
- Cooperative learning
- Experiential learning

The last of these, experiential learning, is a five-step process that requires students to take on an active role. The teacher acts as a facilitator by setting up the exploratory situation and guiding the post-experience discussion.



Tools of Scientific Investigation

Essential to any science classroom are the proper tools for carrying out research and experimentation. Various tools and technology can be used by both teachers and students to enhance the learning experience.

Models are an essential part of science learning as so many scientific ideas rely physical and visual elements. ***Manipulatives*** are interactive models that can be used to demonstrate and explore scientific concepts. This includes:

Tangible Manipulatives	Virtual Manipulatives
• Physical, hands-on manipulatives • Examples: blocks, rods, anatomical models with removable parts, solar system model where the planets rotate and/or revolve	• Computer-based models that allow for virtual manipulation of models by the user • Example: virtual dissection, interactive simulations of simple machines

Tools used to collect experimental data are also an essential part of the science classroom. These may include:

Tool	Purpose
Balance	Measures mass
Barometer	Measures atmospheric pressure (used to study weather)
Graduated cylinder	Measures liquid volume
Magnifier	Used to enhance vision and see small objects with more detail
Microscope	Used to see things too small to be viewed with the naked eye
Scale	Measures weight
Telescope	Used to view objects in space
Thermometer	Measures temperature

With so many tools and materials in use, an important consideration in any experiment is safety. When the classroom doubles as a laboratory space, there are important considerations to keep in mind, such as:

- Ensuring students are closely supervised
- Minimizing roughhousing and other potentially dangerous behavior
- Instructing students beforehand on safety procedures, including the proper handling of equipment, materials, and live animals
- Making sure students know emergency procedures
- Having a first aid kit on hand
- Knowing the location of and how to use a fire extinguisher and fire alarm
- Providing students with appropriate safety gear, such as gloves and goggles
- Making sure students' clothing is appropriate (e.g., hair tied back, no loose clothing around flames, etc.)
- Having a nearby sink and/or eye-washing station
- Making sure all chemicals are labeled and safely stored in a locked cabinet
- Making sure students wash their hands after experiments and clean their equipment and workspaces thoroughly
- Ensuring proper disposal of materials

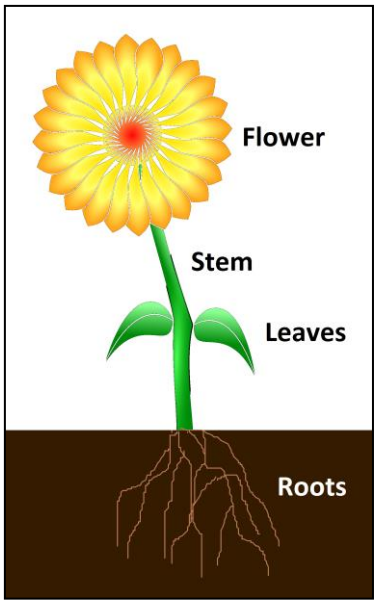
Life Science

Characteristics of Organisms

At the elementary level, much of the life science curriculum surrounds the characteristics of various types of living things (***organisms***). An essential early skill students will need is the ability to differentiate living and non-living things. Students can be taught to identify living things by the following characteristics:

Made of cells	Uses energy
Requires nourishment	Capable of growth and reproduction
Has a definite life span	Responds/adapts to the environment

There are five kingdoms of organisms—animals, plants, fungi, protists, and monera—but at the elementary level, students primarily focus on plants and animals.

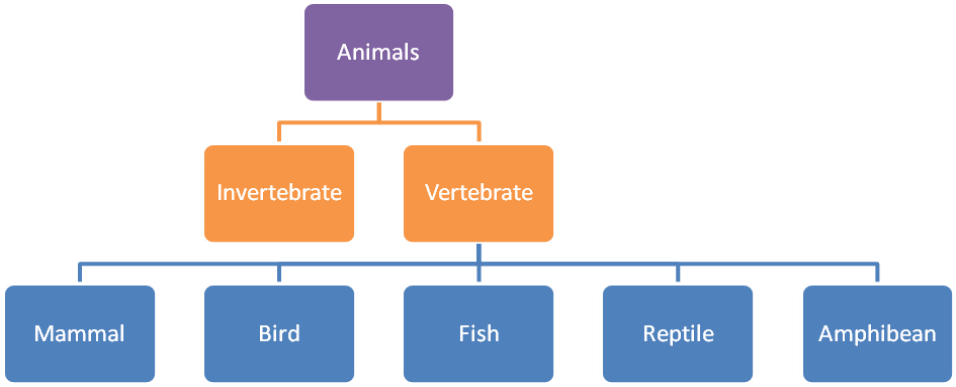


Plants are made up of the following basic parts:

- ***Roots-*** absorb water and nutrients from the soil; anchor the plant to the ground
- ***Stem***- carries nutrients and water from the roots to the rest of the plant
- ***Leaves***- site of photosynthesis (the process by which plants use their chlorophyll, water, nutrients, carbon dioxide, and energy from the sun to make food and oxygen)
- ***Flower***- site of reproduction

Observation and experimentation with different types of plants within the classroom can help students expand their knowledge of the structure and processes of plants.

With animals, students should learn the basic ways they can be classified and the characteristics of each type. Some different ways to classify animals include:

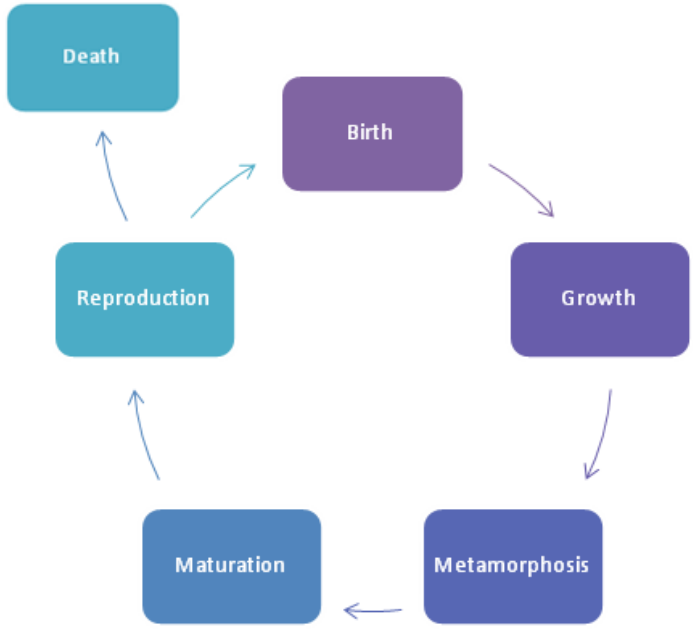


Animals' bodies are made up of several major organ systems that each provides a vital function for life. It is important for students to understand how animals' bodies work and to be able to compare those to their own human bodies. The chart below lists the major systems found in animals, as well as some of the organs involved in the corresponding human systems.

System	Description	Human Body Organs
Circulatory	Transports blood	Heart, blood vessels
Digestive	Provides and processes nutrition	Tongue, esophagus, stomach, intestines
Excretory	Eliminates waste from the body	Kidneys, bladder, skin
Immune	Protects the body against infection	Blood cells, lymph nodes
Muscular/ Skeletal	Provides the body with structure and allows it to move	Muscles, bones
Nervous	Carries electrical signals from the brain to the rest of the body	Brain, nerves
Regulatory (Endocrine)	Manages bodily functions such as hormones and metabolism; helps maintain homeostasis	Thyroid, pancreas
Reproductive	Creates offspring	Ovaries, testes
Respiratory	Exchanges oxygen and carbon dioxide	Lungs, trachea

Life Cycles of Organisms

An important component of life science at the elementary level is an understanding of life cycles. ***Life cycles*** describe the major stages that organisms go through as they experience significant changes during their finite life spans. Each organism has its own unique life cycle, but a general life cycle involves these stages:



Note that even as one organism dies, the cycle shows how the species is able to continue because reproduction leads to new birth.

One of the best ways students can learn about life cycles is through first-hand observation. Small organisms can often be brought into the classroom so that students can watch the changes they go through. Students should keep observation journals where they write and draw what they see as the organism changes over time.

TEST TIP

- Butterflies are commonly used in the classroom for this purpose. Students can watch the metamorphosis process.

Organisms and the Environment

Elementary students also learn about the interactions between organisms and their environments. One of the key concepts in this area

26.) During a writing lesson, a teacher presents her students with the list of words above and asks them to sort them into categories of "Elaboration" and "Contrast." These types of words are examples of
   a) transition words
   b) sensory words
   c) figurative language
   d) temporal words

27.) A student is asked to read the following aloud as part of a nonsense word fluency assessment: "baz, zid, wug, lon." The purpose of this type of assessment is to
   a) provide a test of a child's phonemic awareness that is isolated from preexisting sight words
   b) provide an assessment of vocabulary comprehension
   c) provide instructional emphasis on sight word building rather than phonics-based decoding strategies
   d) determine a child's independent reading level

28.) A student struggling with the concept of text directionality shows a weakness in
   a) phonological awareness
   b) the alphabetic principle
   c) print awareness
   d) visual-motor integration

29.) An informal reading inventory (IRI) is typically administered as a(n) _____ assessment.
   a) summative
   b) diagnostic
   c) anecdotal
   d) intelligence

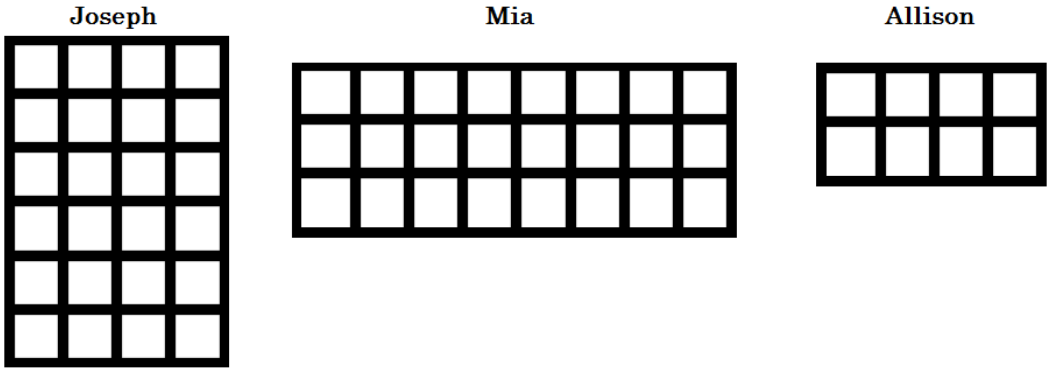
30.) Benchmark writing assessments are primarily used to
- a) assess students' progress toward proficiency against existing standards
- b) diagnose learning disabilities related to literacy
- c) provide students the opportunity to receive peer feedback on their written work
- d) ensure adequate progress in penmanship

42.) Julia is the only student in her class who consistently makes the same type of place value error when performing two-digit multiplication. Which of these strategies would be most beneficial for her teacher to implement first?
- a) Assign Julia extra homework problems to practice the skill
- b) Re-teach the lesson to the whole class
- c) Have her go back to performing one-digit multiplication before trying to move back up to two-digit multiplication
- d) Observe her as she performs a two-digit multiplication

43.) When teaching mathematics to second language learners, it is most important to
- a) give those students the exact same instruction and materials as the rest of the class receives
- b) treat mathematics as independent of language instruction
- c) provide written materials in the native language only
- d) try to determine whether errors are due to a lack of mathematical skills or a language barrier

44.) When comparing fractions, a student says, "1/3 is greater than 1/2 because 3 is bigger than 2." Which of these instructional techniques might be most helpful so that the student understands the error in his thinking?
- a) Giving the student flash cards with inequalities such as "1/2 > 1/3" to commit to memory

b) Using visual models to demonstrate the relative size of fractional pieces
c) Lecturing on the meaning of numerators and denominators
d) Asking the student to write a paragraph explaining his



45.) A teacher asks her students to draw an array to represent a multiplication expression whose product would be 24. Three students' responses are shown above. Which of the students gave a correct response?

a) Joseph
b) Joseph and Mia
c) Allison
d) Mia and Allison

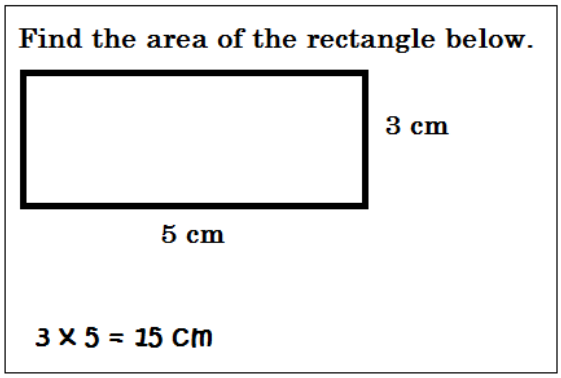
46.) A teacher asked his students to create a word problem based on the following:

12 x 3 =?

Which of the following student responses correctly represents the equation?

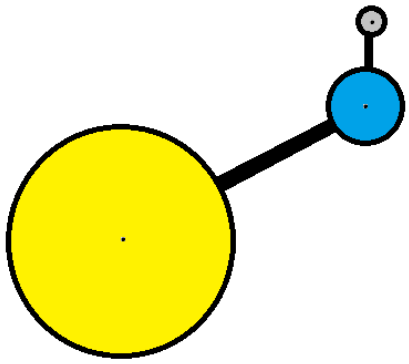
a) Twelve cookies were divided between three friends. How many cookies did each person receive?
b) A pizza was cut into twelve slices. After three slices were eaten, how many slices were left?
c) Three kids each had a box of twelve crayons. How many crayons did they have all together?

d) David drove twelve miles to the store and then three miles from the store to the library. How many miles did he drive all together?



47.) The box above shows a geometry question with Kristen's answer written below. What, if any, is Kristen's error?

a) Kristen has calculated the perimeter rather than the area.
b) Kristen has performed the incorrect operation.
c) Kristen has used the incorrect units.
d) Kristen has not made an error.



65.) Students create models like the one shown above out of cardstock circles, brad fasteners, and thin strips of cardboard. The largest circle is meant to represent the sun, the medium-sized circle represents Earth, and the smallest circle represents the moon. They are connected by cardboard strips attached to brass fasteners, which allows them to move in circular patterns. The concept being illustrated in this activity is

a) rotation
b) revolution
c) tilt
d) polarity

66.) A teacher wants to use an inquiry-based approach to teach her students about metamorphosis using the example of caterpillars transforming into butterflies. Which of these activities would best meet her goal?

a) Show students a video that shows the life cycle of a caterpillar/butterfly
b) Have students draw and label each stage of a caterpillar's/butterfly's life
c) Keep caterpillars in the classroom and have students record observations as they progress into butterflies
d) Lecture to students with visual aids showing the life cycle of a caterpillar/butterfly

67.) A computer-based tool that allows students to perform an interactive simulated dissection is an example of a

a) concrete manipulative
b) virtual manipulative
c) static virtual model
d) web quest

72.) A student is asked to find the elevation of his city using a map. Which type of map will he need to consult?

a) Political
b) Climate
c) Resource
d) Topographical

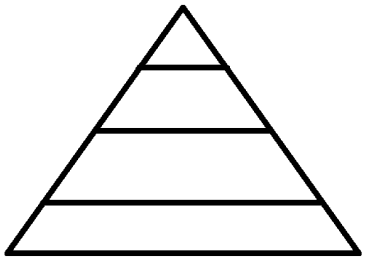
73.) In order to help her students understand why the world's earliest civilizations formed in the locations that they did, a teacher should lead her class to discuss

a) the advantages of mountainous isolation
b) the importance of freshwater as a natural resource
c) the location of the world's oil reserves
d) the rich natural resources available in tropical rainforests

74.) *George Washington's Socks* by Elvira Woodruff, the tale of five friends who travel back in time to meet George Washington at the Delaware River, would be most fitting for a fourth grade class learning about

a) the Civil War
b) the American Revolution
c) the colonization of America

d) the Civil Rights Movement



75.) The graphic organizer above would be most useful for students learning about

a) the geography of Egypt
b) types of climates around the world
c) social classes in ancient Rome
d) trade along the Silk Road

102.) After a lesson on environmental issues, a teacher gives her students the following prompt to lead into an upcoming project: "If you had access to all resources, how would you address the problem of global warming?" This question asks students to use which level of learning?

a) Comprehension
b) Synthesis
c) Evaluation
d) Analysis

103.) When differentiating an assessment, which of these is considered a modification rather than an accommodation?

a) Extended time
b) Separate location
c) Fewer questions
d) Use of a scribe

104.) Which of these elements is NOT essential for cooperative learning to be considered successful?

a) Both individual and group accountability
b) Positive interdependence
c) Ability-based grouping
d) Shared decision-making

105.) Making instructional objectives clear to students encourages

a) cooperative learning
b) metacognitive thinking
c) teacher-centered instruction
d) scaffolding

106.) The purpose of advance organizers is to

a) provide students with a place to take notes and organize information as they read a text
b) optimize the use of the physical classroom space
c) activate prior knowledge before introducing a new topic or concept
d) provide a summative assessment of student learning

ANSWER KEY

26. A
27. A
28. C
29. B
30. A
42. D
43. D
44. B
45. B
46. C
47. C
64. D
65. B
66. C
67. B
72. D
73. B
74. B
75. C
102. B
103. C
104. C
105. B
106. C

26.) **A** These words are transition words, used in writing to guide the reader from one thought to the next.

27.) **A** Nonsense word fluency assessments, in which students are asked to read a series of pseudowords, are designed to test students' ability to pronounce unfamiliar words. Nonsense words are used rather than real words to eliminate the possibility that students are recognizing the words by sight rather than using decoding skills to read them.

28.) **C** Directionality—the understanding that text is read from left to right and then top to bottom—is a basic component of print awareness.

29.) **B** Informal reading inventories are used to determine a student's current reading level. They are often used to diagnose potential reading difficulties and to inform future instruction.

30.) **A** Benchmark writing assessments are given to students as a way to gauge whether or not they are meeting the district or state "benchmarks"—standards—for their grade level.

42.) **D** Watching Julia try to solve one of these problems and listening to her explanation of her thought process can help her teacher to understand why she is making the same error each time and help her to correct the specific issue.

43.) **D** A common struggle with second language learners in any content area is to discover how much of their struggle comes from a lack of skills and understanding in the content area and how much is related to a language barrier. For example, a student may be able to perform multiplication operations correctly but answer multiplication word problems incorrectly because they do not fully understand the language, not because they lack the mathematical skill.

44.) **B** Using a visual model can help this student to better understand the meaning of denominators and their effect on the relative size of fractions. In this instance, the student could be shown two identical circles. One could be split in two pieces with one piece shaded and the other circle could be split into three pieces with one piece shaded. This would show the student that 1/2 is actually greater than 1/3 because the student could see which piece was larger visually.

45.) **B** Joseph and Mia have each correctly represented 24 as a product of multiplication. Joseph's array shows 6 x 4 = 24 and Mia's array shows 3 x 8 = 24. Allison's array is incorrect because it shows 2 x 4 = 8.

46.) **C** Choice (C) is the only one that asks for a product. 12 crayons x 3 kids = 36 crayons.

64.) **D** The control group in this experiment is the uncovered leaf because it shows what would happen naturally, without the interference of the construction paper (variable).

65.) **B** This model provides students with a demonstration of how the Earth revolves around the sun and the moon revolves around the Earth.

66.) **C** Inquiry-based learning is a hands-on approach in which students are directly involved in investigation. Observing the process of metamorphosis via live caterpillars is an example of inquiry-based learning.

67.) **B** A virtual manipulative is a computer-based model which students can interact with and manipulate like a concrete (physical) manipulative. This is in contrast to a virtual static model, which is a computer model that is not interactive.

72.) **D** A topographical map shows elevation (height relative to sea level).

73.) **B** The world's first civilization developed in river valleys due to the importance of freshwater for drinking, agriculture, travel, and trade.

74.) **B** The story of Washington crossing the Delaware River occurred when he was a Revolutionary War general.

75.) **C** Pyramid diagrams are used to show hierarchical relationships, such as social classes.

102.) **B** Synthesis requires students to use their knowledge to create something new through actions such as planning, creating, inventing, composing, or formulating. Creating a plan to deal with global warming falls under this category.

103.) **C** An accommodation is an adaptation of the way the test is given. This may include a change in timing, setting, or method of response (e.g., use of a scribe or word processing). A modification, on the other hand, changes the content of the test. Reducing the number of questions for a particular student falls under that category.

104.) **C** Cooperative learning groups do not necessarily have to be ability-based. In fact, mixed ability groups often provide students with more meaningful shared learning opportunities.

105.) **B** If students are aware of instructional objectives—what they are expected to learn and do—they can take responsibility for their learning by evaluating their own level of learning and thinking about their learning process (metacognition).

106.) **C** Advance organizers are tools used at the beginning of a lesson or unit to tap into students' background knowledge about a subject and make connections between the new topic and what they already know.