LISELL
Lesson Starters

Using the Academic Language of Science

Revised Jan 2012

Teacher Background
LISELL Academic Language Practice 2
Use of the Academic Language of Science

It is important for students to understand and be able to use the language structures that are unique to science – what we refer to as the **Academic Language of Science**. While the use of general academic vocabulary focuses on common vocabulary across the academic subjects, the focus on *the academic language of science* is about **features of language use that are unique to science**. Science, more than the other content areas, frequently uses language patterns in writing and speaking that sound alien to many students. These language patterns have developed for useful reasons – to support the communication of scientific thinking – but they also confuse students and make science seem to be more complex and harder to understand than it actually is. We believe that instruction focused explicitly on the language of science can help all students to better understand and communicate scientific ideas, but is especially important for English language learners.

To help your students develop and use the *Academic Language of Science* we recommend several LISELL strategies to make the academic language of science more understandable.

1) *Build students' "word consciousness" by breaking down the* ***technical nature of scientific vocabulary.*** Unlike the general academic vocabulary, the technical vocabulary of science overwhelmingly comes from Greek and Latin roots, prefixes and suffixes (arthropoda, nocturnal, etc.). *You can help your students understand the technical features of the language of science by explicitly analyzing science-specific vocabulary through their prefixes, suffixes and roots, discussing how the words function in a text, and by practicing using these terms in multiple ways.*

2) *Understand the* ***abstract and depersonalized*** *nature of scientific language created through the use of nominalization and passive voice.* We know when we hear language that sounds "scientific." In addition to the technical vocabulary, another key feature of this scientific discourse is the use of abstract nouns. Abstract nouns (e.g., significance, distillation) are created by taking processes (verbs) or qualities (adjectives) and expressing them as abstract things (nouns) – a process called "nominalization." Nominalization removes or suppresses the actor (often the scientist) and promotes the use of passive voice, making science seem more objective and focusing on what is done rather than on who or what is doing it (e.g., trees are cut down resulting in loss of soil; measurements are taken to check for increased ozone levels). *You can help your students to understand the abstract and depersonalized nature of science discourse by explicitly pointing out abstract nouns and passive voice in science texts and by having students re-write science texts (such as for a "younger audience") in ways that explicitly include the actors, use active voice and make the language less abstract and more concrete.*

3) *Understand the* ***dense*** *nature of the academic language of science through practice deconstructing and constructing clauses in science text.* Science text is dense, allowing science writers to pack a large amount of information into a compact number of sentences. Clauses in science texts typically contain many more processes, participants and circumstances than

clauses in everyday language (e.g., the two tropical rain forest hot spots in South America that have not yet been completely explored). These dense clauses are usually formed by a noun (hot spots) with multiple pre-modifiers (two tropical rain forest) and post-modifiers (in South America that have not yet been completely explored). *You can help your students to understand the dense nature of science discourse by having them break down (deconstruct) complex clauses into their parts and by practicing expanding simple nouns by adding their own pre- and post-modifiers.*

4) *Give students* ***more practice talking science***. The typical question-answer-evaluation (triadic dialogue) discourse pattern between teacher and students fails to give students adequate opportunity to talk, to ask their own questions, and to discuss science while doing practical work. *You can help your students by consciously changing the discourse pattern in your classroom with the goal of giving students more frequent opportunities to ask questions, talk in pairs and peer groups, explain scientific concepts, and generally use more language than just short responses to your questions.*

5) *Teach students how to* ***express science ideas in multiple ways***. Students often learn to express things in science in just one way (They learn that "a hypothesis is an educated guess" or that "density is the mass divided by the volume"). Teachers may assume that when students say these things they have a conceptual understanding of what these statements mean. In fact, asking the student for elaboration often uncovers that the student has memorized this response with only a limited conceptual understanding. If a person can only say something in one way, they have probably only memorized it. Once we can express an idea in multiple ways, we can be sure that we more fully understand its meaning. *You can help your students practice expressing science ideas (spoken and written) in multiple ways to reinforce this idea that to "say it another way" is evidence of conceptual understanding.*

6) *Make time for students to* ***discuss their everyday understandings of topics using everyday language***. Students need to be able to compare everyday ways of talking and thinking about topics with more scientific ways of talking and thinking about those same topics. Even if these everyday understandings are not scientifically correct, they serve as a valuable starting point for learning the relevant science concepts and relevant science language. *You can help your students make these connections by dedicating time to explicitly discussing the everyday ways of talking and thinking so that these can then be compared to the more scientific approaches.*

7) Students need ***practice writing in the academic language of science, including on assessments***. Students need regular and ongoing practice writing in the academic language of science as an important part of learning to communicate scientifically. Practice with science writing can support improved ability in science talk and *vice versa*. Formative assessments such as lesson starters, lab reports, and "tickets out the door," can provide such ongoing practice, especially if students are required to write in full sentences. Summative assessments, such as science tests, should also require full sentence length written answers because in the end, tests send the clearest message about what is important to learn. Multiple choice tests tell students that what is important is memorization, not meaning. Written responses highlight the value of meaning. *You can help your students learn to use the academic language of science by requiring students to "write and talk science" on a daily basis.*

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Severe Weather Preparation

The mayor of your **community** has asked for middle school science students to help **develop** a plan for all citizens to be better **prepared** if a hurricane or tornado is **predicted** to hit your town. Write a short letter to the mayor, using scientific language, to explain your ideas about what the people in your town need to do to be safe in a hurricane or tornado.

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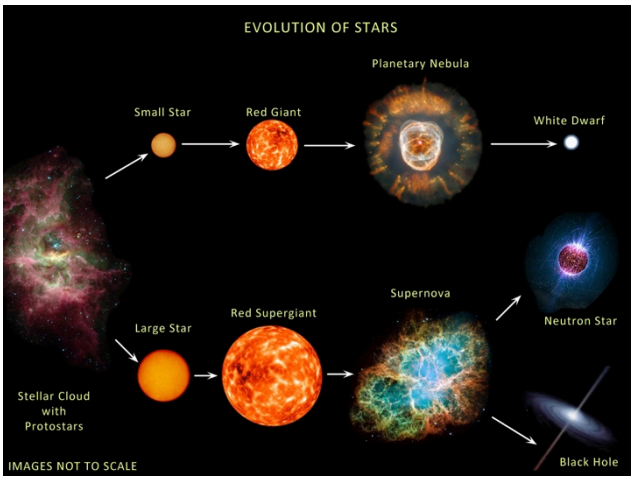
The Nature of Evolution



Evolution is a broad **theory** that is used to explain many changes in the natural world that have taken place over time. The idea that **current** life forms have **evolved** from earlier life forms is just one part of the larger theory of evolution. Evolution of living organisms is sometimes referred to as **descent** with **modification** or evolution through natural **selection**.

Evolution also **provides** a **framework** for explaining the changes scientists can **observe** in galaxies, stars, planets, landforms, and geography. **Evidence** for the nature of these changes can be drawn from a wide **range** of scientific **disciplines** including: astronomy, geology, paleontology, biochemistry, biology, ecology, and anthropology. Evolution serves as one of the most important **unifying concepts** in science. Thus, an understanding of the theory of evolution, the evidence that supports it, and the questions that remain, is an **essential** part of learning science.

<u>Work with a partner and do one of the following activities to make this paragraph from a science book more understandable for students:</u>
1) Choose one sentence from the paragraph and rewrite it in everyday language.
2) Pick a word you don't know and look it up. Then use it in a sentence about a different science topic.

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Healthy Eating at School

Your principal has **invited** science classes at your school to make a plan for how to help middle school students eat healthier meals at school and get more exercise. Write a short letter to your principal, using scientific language, explaining your ideas about how things could be changed at your school so that students could eat healthier lunches and get more exercise.

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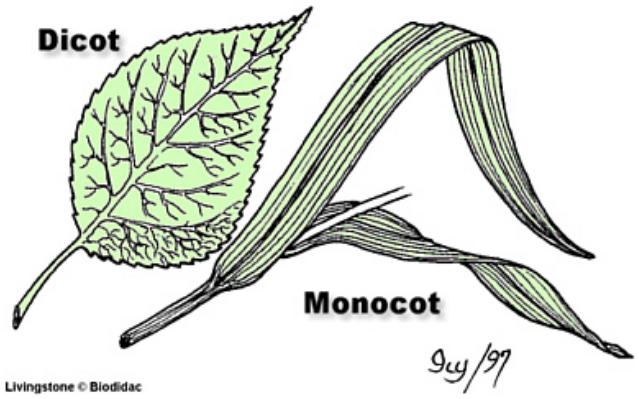
Monocot versus Dicot Plants



Flowering plants have **evolved** into two **subdivisions** known as monocots and dicots. The **classification** depends on the **structure** of the plant's leaves. Monocots have leaves with **parallel** veins that are usually **organized** in groups of three. Dicots have leaves with veins that branch in netlike structures and are usually organized in groups of four or five. Each **represents** a very different type of plant structure. Dicot leaf growth is at the top or leading edge of a leaf, while monocot plants grow from their leaf **base**. Examples of a monocot plant include a blade of grass and a cornstalk. Examples of a dicot plant would be a maple, oak, or rosebush.

<u>With a partner, do one of the following activities to make this paragraph from a science book more understandable for students:</u>
1) Choose one word that has either a prefix or a suffix. Identify the prefix or suffix and what it means. Share your word with a partner.
2) Pick a word you don't know and look it up. Then use it in a sentence about a different science topic.

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Climate Change

The Earth's climate is a **dynamic** system—it does not stay the same over time. Scientific **data** from glaciers, coral reefs, fossils, and other **sources** tell us that the climate in any particular place on Earth has changed many times in the past and will continue to change in the future. In the past, there have been heat waves and ice ages that have lasted thousands of years. These climate changes are a natural part of the **interactions** between the different Earth systems and would happen regardless of humans or what we do. Thus, climate changes can be natural—but they can also be human made. Today, the scientific **evidence** is that the Earth's climate is warming very quickly and that this warming is at least **partially** a result of actions by people. This rapid climate change is known as **global** warming. If this **pattern** of global warming continues, there are likely to be **dramatic** and rapid changes in weather and climate patterns. The most serious result of these changes may be a rise in sea level caused by the melting of glacial ice. In both the northern and southern hemispheres, icebergs are **currently** melting more quickly than in the past.

With a partner, do one of the following activities to make this paragraph from a science book more understandable for students:

1) Choose one sentence from the paragraph and rewrite it in everyday language.
2) Think of one question you have about the paragraph. Ask your question to your partner and then both of you discuss your ideas for a minute.

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Bird Watching

Ornithology is the study of birds. It is a science that everyone can **participate** in because birds exist in every **environment** where people can live (and even in some environments where people can't) and birds are easy to **observe**. You can track certain bird behaviors such as feeding patterns, **migration** patterns, and reproductive patterns by regularly observing the birds around your house or school.

To observe more birds, you can build a bird feeder. Then you can easily **monitor** the birds that visit the feeder. You can track the species of birds, their **preferred** foods and whether or not they **migrate** for the winter. Feeders are especially helpful to birds during the winter when non-migratory species of birds have a much harder time gathering **sufficient** food. In the spring and summer, most small non-migratory birds eat a diet of insects. In the fall, as the insects die off, their diet changes to mostly berries and seeds. In the winter, even berries and seeds become scarce and many birds struggle to find enough to eat.

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Weather Instruments

Weather **describes** short-term changes in the atmosphere. Today, scientists use modern **technology** to measure and collect weather **data** and make weather **predictions**, but weather prediction is actually a very old science. For thousands of years, weather prediction has helped to guide the planting and harvesting of crops, **migrations**, and the timing of festivals. It was not until the 16th century, however, that tools were invented to collect weather data scientifically.

The first thermometer (In Greek, *thermos* means heat and *meter* means measure) was invented in 1593 by the Italian scientist Galileo Galilei (1564–1642) to more **accurately** measure temperature. Thermometers work because changing temperatures cause liquid to **expand** or **contract** and thus rise or fall in a tube.

To measure wind speed, the Italian architect Leon Battista Alberti invented the anemometer (*anemos* is Greek for wind). The anemometer uses small cups that spin around a **central** pole. The cups change speed depending on how fast the wind is blowing.

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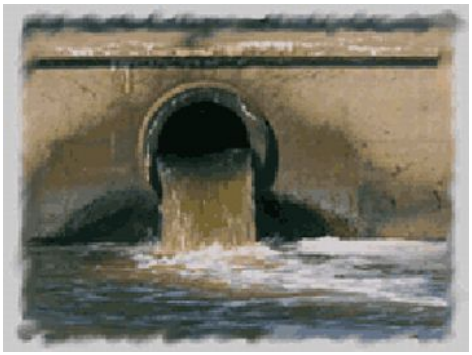
Point Source and Non-Point Source Pollution



Pollution is generally **classified** as being either point-**source** pollution or non-point-source pollution. Point-source pollution is when there is a single **specific location** and activity that is responsible for producing pollution, like a factory that is **releasing** dangerous chemicals into a river. Non-point-source pollution is when there are multiple locations and/or activities that are causing the problem, as when rain washes fertilizer out of many farmers' fields. It is possible to **trace** point-source pollution back to the source (such as a factory) and force them to reduce the pollution.

Non-point-source pollution can be harder to track and reduce because it is coming from many different sources. This type of pollution can be just as damaging to the **environment** as a big polluting factory. Common non-point-source pollutants include:

- Oil and other chemicals from cars, roads, and parking lots
- Fertilizers, herbicides, and insecticides from farms and homes
- Litter and trash that are not properly **disposed** of
- Animal waste from livestock and pets
- Soil that **erodes** from farms, construction **sites**, and parking lots

<u>With a partner, do one of the following activities to make this paragraph from a science book more understandable for students:</u>
1) Write a sentence describing one thing that you could do personally to help reduce non-point-source pollution. Read it to a partner.
2) Choose one sentence from the paragraph and rewrite it in everyday language.

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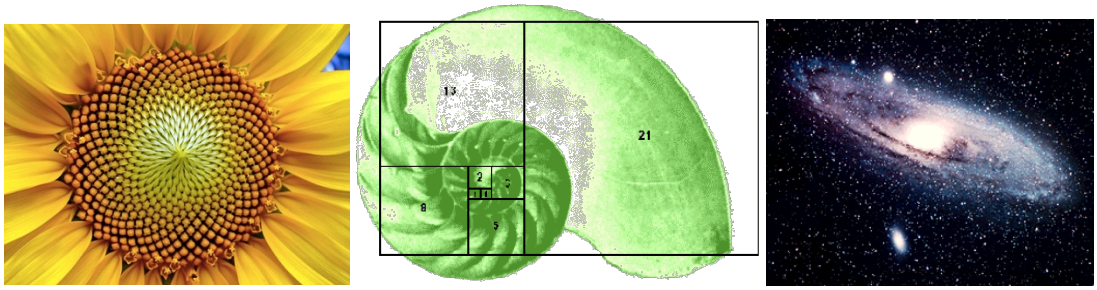
Patterns in Nature



Patterns can be found everywhere in nature and in the human-**designed environment**. Mathematicians have always loved to study patterns. The Italian mathematician Leonardo Fibonacci (1175–1250) wrote a book called *Liber Abaci* that first introduced Arabic numbers (0,1,2,3…) into Europe. Before that time, Europeans were still using Roman numbers (I, II, III …) Fibonacci also **described** a number pattern in his book where every two numbers in the pattern equal the third number in the pattern. The pattern looks like this:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144

This pattern, now called the *Fibonacci* ***sequence***, can be found many places in nature, such as in the centers of flowers, the shape of seashells like the chambered nautilus, and the pattern of a spiral galaxy. What other patterns can you find in nature?

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Where Your Food Comes From

Food **production** and **distribution** is now a worldwide **enterprise**. The banana you ate with your breakfast most likely came from Central America, your coffee or tea from Brazil or Asia. The hamburger you had for lunch probably **contained** a **combination** of beef from North American and South American cattle, and the vegetables you had with your diner most likely came from Mexico or California. For a **typical** Georgian, it is highly unlikely that a single food item that you ate today came from a plant or animal that was **raised** within 20 miles of where you live. This was not the case just a few **generations** ago.

Transportation has become a much larger part of the modern food **industry**. Transportation **involves** getting the food from where it is **produced** to where it is **processed** and then from where it is processed to where it is sold. Food that is transported long distances uses more fuel, causes more pollution and is not as fresh as food that is produced locally. So what caused this **massive** change in the food industry? Maybe your class can do some research and find out.

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Where Your Garbage Goes

Landfills are the **major method** of **disposing** of solid waste materials in North America. Landfills are large holes that are dug in the Earth, lined with plastic to **reduce** leaking, and then filled with garbage. Landfills are popular because of their **simplicity** and **versatility**. Landfills are not **sensitive** to the shape, size or weight of the waste material—most anything can be put in.

This year, Americans will **create approximately** 250 million tons of solid waste (an average of 4.5 pounds of trash per person per day) and about 67% of this waste will be dumped in landfills. With all this trash, our landfills are filling up quickly! It can be hard to find places to build new landfills because nobody wants a giant trash mountain in their neighborhood.

There are **alternative** methods of waste **disposal**, such as recycling, incineration, and composting. About 70% of the solid waste that is being disposed of in landfills could be recycled instead. There are also many things we could do to reduce the amount of waste we **produce**.

With a partner, do one of the following activities to make this paragraph from a science book more understandable for students:

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