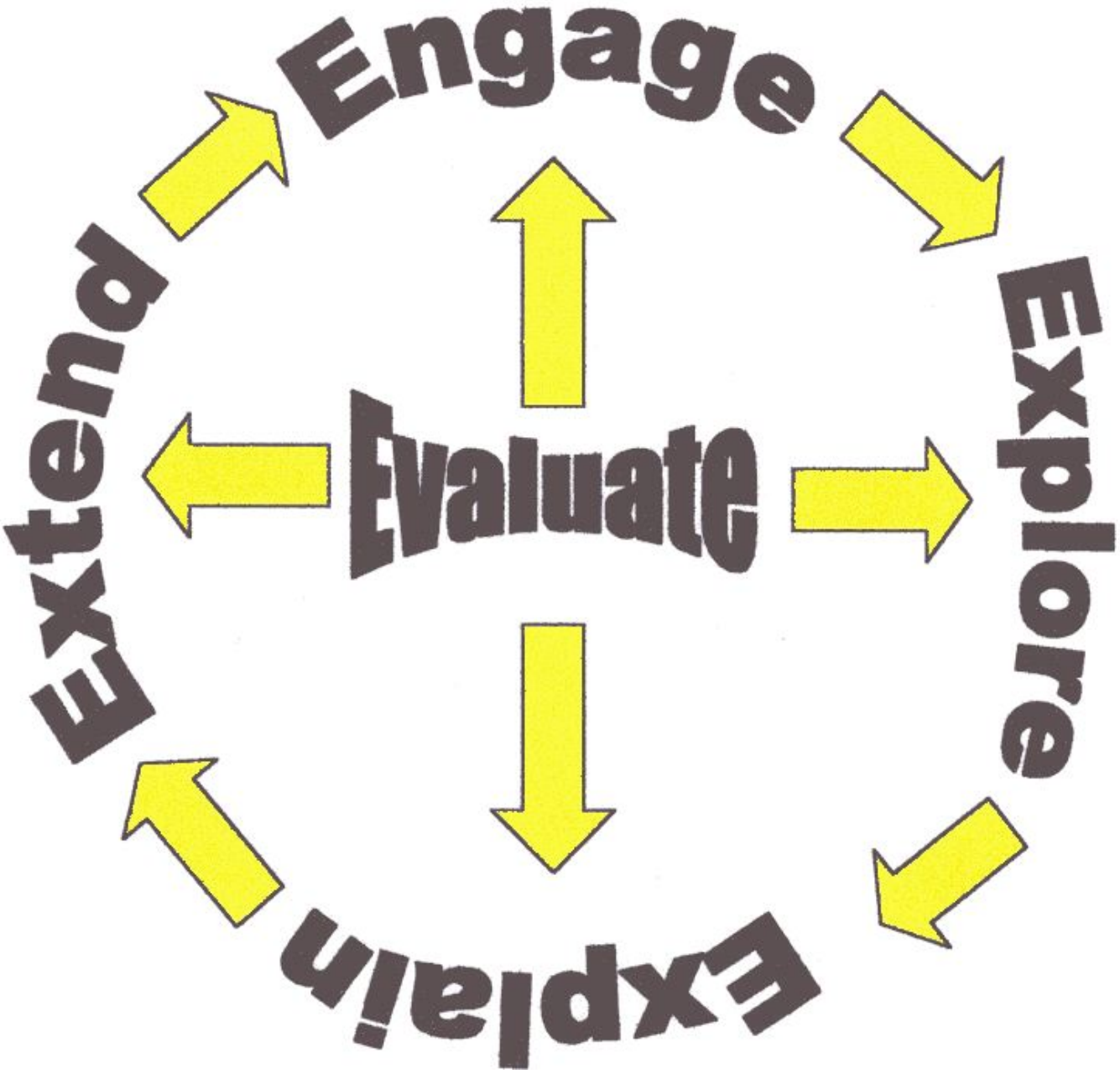

The 5E Model of Teaching

Grade 2

Students' Role and Actions in the 5E Model

"5E's"	Consistent with Model	Inconsistent with Model
Engage	● Asks question such as "why did this happen? What do I already know about this?" ● Shows interest in the topic	● Asks for the "right" answer ● Offers the "right" answer ● Insists on answers or explanations ● Seeks on solution
Explore	● Thinks freely but within limits of the activity ● Tests predictions and hypotheses ● Forms new predictions and hypotheses ● Tries alternatives and discusses them with others ● Records observations and ideas ● Suspends judgement	● Passive involvement ● Works quietly with little or no interaction with others ● "Plays around" indiscriminately with no goal in mind ● Stops with one solution
Explain	● Explains possible solutions or answers to others ● Listens critically to others' explanations ● Questions others' explanations ● Listens to and tries to comprehend explanations offered by teacher ● Refers to previous activities ● Uses recorded observations in explanations	● Proposes explanations from "thin air", with no relationship to previous experiences ● Brings up irrelevant experiences and examples ● Accepts explanations without justification ● Does not attend to other plausible explanations
Elaborate	● Applies new labels, definitions, explanations and skills in a new but similar situation ● Uses previous information to ask questions, propose solutions, make decisions and design experiments ● Draws reasonable conclusions from evidence ● Records observations and explanations ● Checks for understanding among peers	● "Plays around" with no goal in mind ● Ignores previous information or evidence ● Draws conclusions from "thin air" ● In discussion, uses only labels provided by teacher
Evaluate	● Answers open-ended questions by using observations, evidence, and previously accepted explanations ● Demonstrates understanding or knowledge of concept or skill ● Evaluates his or her own progress and knowledge ● Asks related questions that would encourage future investigations	● Draws conclusions without using evidence or previously accepted explanation ● Offers only "yes" or "no" answers and memorized definitions or explanations as answers ● Fails to express satisfactory explanations in his or her own words ● Introduces new, irrelevant topics

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades PreK-2 Core Scientific Inquiry, Literacy and Numeracy *How is scientific knowledge created and communicated?*	
Content Standards	**Expected Performances**
SCIENTIFIC INQUIRY ♦ Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. **SCIENTIFIC LITERACY** ♦ Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science. **SCIENTIFIC NUMERACY** ♦ Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**A INQ.1** Make observations and ask questions about objects, organisms and the environment. **A INQ.2** Use senses and simple measuring tools to collect data. **A INQ.3** Make predictions based on observed patterns. **A INQ.4** Read, write, listen and speak about observations of the natural world. **A INQ.5** Seek information in books, magazines and pictures. **A INQ.6** Present information in words and drawings. **A INQ.7** Use standard tools to measure and describe physical properties such as weight, length and temperature. **A INQ.8** Use nonstandard measures to estimate and compare the sizes of objects. **A INQ.9** Count, order and sort objects by their properties. **A INQ.10** Represent information in bar graphs.

Grade 2

Physical Science

Properties of Matter

Solids, Liquids and Gases

Content Standard

The student will know the characteristic properties of matter and their relationship to structure and composition.

Focus Questions:

What are the forms of water?
What are the properties of a solid? (color, size, shape, mass, texture)
What is the difference between a solid and a liquid?
How does a gas differ from a solid and a liquid?

Essential Understandings:

- Everything is matter.
- The three states of matter are solid, liquid, and gas.
- Each state of matter has unique characteristics.
- Matter may change its state.

Suggested Activities:

Separate and compare objects according to their properties.
Describe objects and record data in terms of their physical properties.
Observe and compare several different liquids and record data.
Make predictions using liquids.
Compare behaviors of liquids.
Examine substances and determine their states of matter.
Devise experiments that demonstrate changes in matter and predict outcomes.
Combine materials to create oobleck.
Boil water to show change from liquid to gas.
Heat ice to show change from solid to liquid to gas.
Combine vinegar and baking soda in a bottle and attach balloon to its neck to

show release of gas.
Compare the weights of an inflated and deflated ball to show air has weight.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe the properties of matter
Communicating:	Discuss the properties of various substances and determine its state
Comparing:	Compare behaviors of solids and liquids
Applying:	Investigate a substance and infer if it is a solid or a liquid
Predicting:	Predict if air has weight

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Oobleck and Glurch

Oobleck and Glurch --Learning about Solids and Liquids

A great way to teach early grade schoolers about solids and liquids is with Oobleck and Glurch. Oobleck is a non-Neutonian fluid. This means that when a small amount of force is used, it acts like a liquid, but when more force is applied, it acts like a solid. For instance, one can slowly put a spoon in Oobleck, but it is impossible to stir it quickly. Another fun activity (though potentially messy!) is to pour a little Oobleck in the palm of your hand and watch it puddle like a liquid. Now make a fist and quickly open your hand. The Oobleck will have formed a hard ball from the pressure of your fist; but when the pressure is release, it will seem to "melt" into a liquid again.

Glurch is a polymer that the children can actually watch polymerize. By mixing two liquids together and stirring, a sticky, gooey ball will form; this is Glurch. Because the newly formed Glurch has water trapped in its polymer matrix, it also exhibits a lot of the characteristics of solids and liquids. Though it seems solid, it will actually "pour" very slowly and it will take the shape of its container. Yet it sticks together and can all be picked up at once.

The following is a lesson plan that lets students make there own assumptions about solids and liquids and then test those assumptions -- just like real scientists! The recipies for Oobleck and Glurch are also included.

I. Describe solids and liquids.

Though most students can name a dozen solids or liquids, they usually don't know about the molecular differences. I find that it is easy to explain with a model. Cheerios work great for liquids -- they roll around, take the shape of the container and aren't bound to one another. Several Legos stuck together are the perfect solid -- they alway keep their shape, are hard to the touch, and stick together. I try to use the models only after a student has named a bunch of solids and liquids. Problems you might encounter include sand and pillows. It is difficult to explain why these are solids and not liquids, so be creative!

What can we do to tell them apart?
Ask the students what is something that is different in every solid and every liquid and how they could test that. They should come up with the following for tests.
1. push test -- can you push into it?
2. pick up test -- if you pick some up, does it all come up?
3. pour test -- does it pour out smoothly, or does it just fall out in a clump?
4. shape test -- does it keep the same shape?

Either on the board, or on their own, have the students make a chart of these rules so that they can test any new materials by seeing if they match.

II. Distribute oobleck.

You will definetly need to leave time for the students to play with it.

Make observations. This is when the students can run the four test on it and see how it reacts. Older students could write a more detailed description.

Is it a solid or a liquid? Actually, it is both in a way. Oobleck is a non-neutonian liquid. All that means is that it is a liquid that doesn't follow Newton's equations for liquids under pressure. I haven't found a good model for this, but some students might have seen glass in very old buildings that is thin at the top and thick at the bottom. That is because glass is also a non-neutonian fluid and is slowly flowing out of the pane.

III. Distribute two pre-Glurch solutions and mixing stick.

Make observations. Just like above, students should review the chart they made and decide whether they have a solid or a liquid.

What will happen if we mix two liquids? I like to use the example of milk and apple juice. It is also good to go back to the cheerios model and add another pseudo-liquid, maybe M and M's.

IV. Mix solutions.

You will definitely need to leave a lot of time for the kids to fool around with this stuff -- they love it!

Make observations.

Is it a solid or a liquid? Again, it has properties of both. This is because there is still water stuck in the polymer matrix; dried Glurch acts very differently. The best model for Gluch I have found is one of those magnet-art toys that have a magnetic base and numerous small metal pieces that can be shaped any which way.

V. What did we learn?

I like to make sure that the students understand that in science, things aren't always what you expect (mix two liquids and get a polymer) and that not everything falls into neat categories (non-neutonian fluid). Often there is a child that wants to know what will happen if they mix Oobleck and Glurch. Though this results in a compound that is not as interesting as either alone, that type of inquistivness is wonderful!

Recipies

Oobleck:
I would recommend making about a quart for 25-30 students, but the amount really doesn't matter.

1/2 quart water
about 2 boxes cornstarch
food coloring

Put the water and food coloring in a large bowl and begin adding the corn starch and mixing. Eventually the mixture will get thicker; keep adding and stirring. You will know when you have Oobleck!

Glurch:
water
white glue
sodium borate
food coloring

There are actually two solutions for Glurch. The first is 50% water, 50% white glue and food coloring. The second is a nearly saturated solution of sodium borate (I would experiment to see how much you actually need. I usually just dump a couple tablespoons in a half quart and shake.) Give the students equal volumes of the two solutions to mix.

Lesson Plan developed by Science Connector Becky Mosher

Grade 2

Life Science

Structure and Function

Plants and Animals

Content Standard

The student will understand plants change their form as part of their life cycles.

Focus Questions:

What are the stages of the plant life cycle?
How will light and dark affect seed growth?
How will the amount of water affect seed growth?
How does the plant change during each stage of life?

Essential Understandings:

- Seeds are found in the plant part called a fruit.
- Different kinds of fruits have different kinds and numbers of seeds.
- Seeds have a variety of properties.
- Seeds undergo changes in the presence of water.
- A seed is an organism, a living thing.
- Germination is the onset of a seed's growth.
- Plants require nutrients.
- The life cycle is the process of a seed growing into a mature plant, which in turn produces seeds.
- A food chain begins with green plants and energy is passed to the consumers.

Suggested Activities:

Conduct a seed hunt to show different types of seed dispersal.
Dissect seeds and fruits-describe and compare seed properties.
Construct small group and class seed sprouters.
Examine germinated seeds.
Set up a classroom hydroponic garden.
Grow plants in different environments.

Measure plant growth.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe stages of plant growth
Communicating:	Describe and record the germination of seeds grown in a hydroponic garden
Comparing:	Compare types of seeds
Organizing:	Graph growth of seedlings
Applying:	Germinate seeds and grow them in a hydroponic garden
Predicting:	Predict which seeds will germinate first Predict how environmental elements will affect plant growth

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Grade 2
Earth Science
The Changing Earth
Soil, Pebbles, Sand and Silt

Content Standard

The student will understand properties of Earth materials.

Focus Questions:
What is a rock?
How is a rock formed?
What is Soil?
How is soil useful?
What is clay?

Essential Understandings:
- Earth materials have different properties.
- Earth materials can be sorted according to their properties.
- Rock, pebbles, sand, silt, clay, loam, and humus make up the Earth's crust. a Some soils retain water better than others.
- Soil supports the growth of many plants that are used for food supply.
- Tools, such as hand lenses, can be used to observe properties (particle size, composition and other physical characteristics) of soils.
- Earth materials are used in construction.

Suggested Activities:
Design an experiment to discover how Earth materials retain water.
Sort, observe, and compare rocks according to their properties.
Use hand lenses to observe the effects of Earth material experiments.
Experiment using screens to separate Earth materials.
Discover the properties of dry and wet clay.
Grow seeds in Earth materials (rock, pebbles, sand, silt, clay, loam, and humus) to chart growth differences.
Creation of stepping stones from cement and Earth materials.
Observe and record the results of Earth material experiments using vials.

Search for Earth materials outdoors during a field study.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe experimental results
Communicating:	Describe Earth materials using specific vocabulary
Comparing:	Compare soil, pebbles, sand, and silt
Applying:	Experiment to find how different Earth materials hold water
Predicting:	Predict which soil samples will best support plant growth

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Grade 2
Life Science
Nutritional
Needs for Survival Nutrition

Content Standard

The student will understand that human beings have special nutritional needs for survival.

Focus Questions:
What are the essential components of balanced nutrition as described by the food pyramid?
Which plant and animal sources best meet the nutritional needs of human beings?
Which foods supply people with the essential nutrients?

Essential Understandings:
- Photosynthesis is the basis for the formation of food energy and is essential to human life.
- Food provides energy for people to move, to think, and for the functioning of their bodies' systems.
- Water is essential for sustaining life.
- Nutrients are essential for life, rebuilding or repairing the body.
- Food is made of chemicals called nutrients which include macronutrients: proteins, carbohydrates, fats and micronutrients: vitamins, minerals.

Suggested Activities:
Chart food intake.
Make a collage of the different food groups.
Create a healthy, balanced daily menu incorporating the food groups.
Research recipes for healthy Snacks.
Make a healthy snack.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Identify properties of selected foods Identify foods that contain carbohydrates, proteins and fats
Communicating:	Compare a healthy diet to an unhealthy diet Develop an awareness of the nutritional value of each of these components
Relating:	Classify foods by nutritional components
Inferring:	Infer the nutritional value of foods Make inferences between the nutritional components of some foods and personal health
Applying:	Design and implement a healthy menu
Predicting:	Predict the category foods fall under in the food pyramid Predict the effects of a poor diet on your growing body

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Grade 2 Core Themes, Content Standards and Expected Performances	
Content Standards	**Expected Performances**
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **2.1 - Materials can be classified as solid, liquid or gas based on their observable properties.** ♦ Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.	**A 18.** Describe differences in the physical properties of solids and liquids.
Structure and Function – How are organisms structured to ensure efficiency and survival? **2.2 - Plants change their forms as part of their life cycles.** ♦ The life cycles of flowering plants include seed germination, growth, flowering, pollination and seed dispersal.	**A 19.** Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds. **A 20.** Explore and describe the effects of light and water on seed germination and plant growth.
The Changing Earth – How do materials cycle through the Earth's systems? **2.3 - Earth materials have varied physical properties which make them useful in different ways.** ♦ Soils can be described by their color, texture and capacity to retain water. ♦ Soils support the growth of many kinds of plants, including those in our food supply.	**A 21.** Sort different soils by properties, such as particle size, color and composition. **A 22.** Relate the properties of different soils to their capacity to retain water and support the growth of certain plants.
Science and Technology in Society – How do science and technology affect the quality of our lives? **2.4 - Human beings, like all other living things, have special nutritional needs for survival.** ♦ The essential components of balanced nutrition can be obtained from plant and animal sources. ♦ People eat different foods in order to satisfy nutritional needs for carbohydrates, proteins and fats.	**A 23.** Identify the sources of common foods and classify them by their basic food groups. **A 24.** Describe how people in different cultures use different food sources to meet their nutritional needs.