Working with K-12 Teachers

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Overview of Presentation

- Types of K-12 Education programs
- Support for pre-service teachers
- Support for in-service teachers
- Types/examples of activities
- Types/examples of assessments

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K-12 Education Programs

- Undergraduate programs
  - K-5 and Middle School programs
  - Often leads to an education degree
  - Students most likely non-science majors
- Graduate programs
  - All levels including High School
  - Compressed schedule
  - Wide diversity of student backgrounds and educational levels

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What they need from us

- Courses that integrate into their education program
  - Modeling of inquiry and hands on activities
  - Opportunities to produce work for graduation portfolios (alternative assessments)
  - An awareness of course content relevance to society
  - Connections between content and local state education standards

What they want from us

- Relevance of course to their career
- Scaffolding (especially for non-science majors)
- Explanation for our chosen pedagogical style

Relevance

- Geoscience in the news assignment
- Use of K-12 materials in class
  - Supplementary readings from K-12 texts
  - Lesson plan assignments

Scaffolding for Non-science Majors

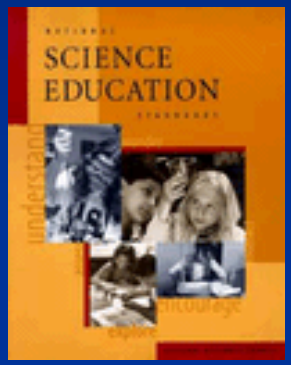
- Graphing skills
- Algebra, trigonometry and manipulation of units
- Conceptions of map and cross section views
- Reading and writing skills

Scaffolding for Topographic Maps

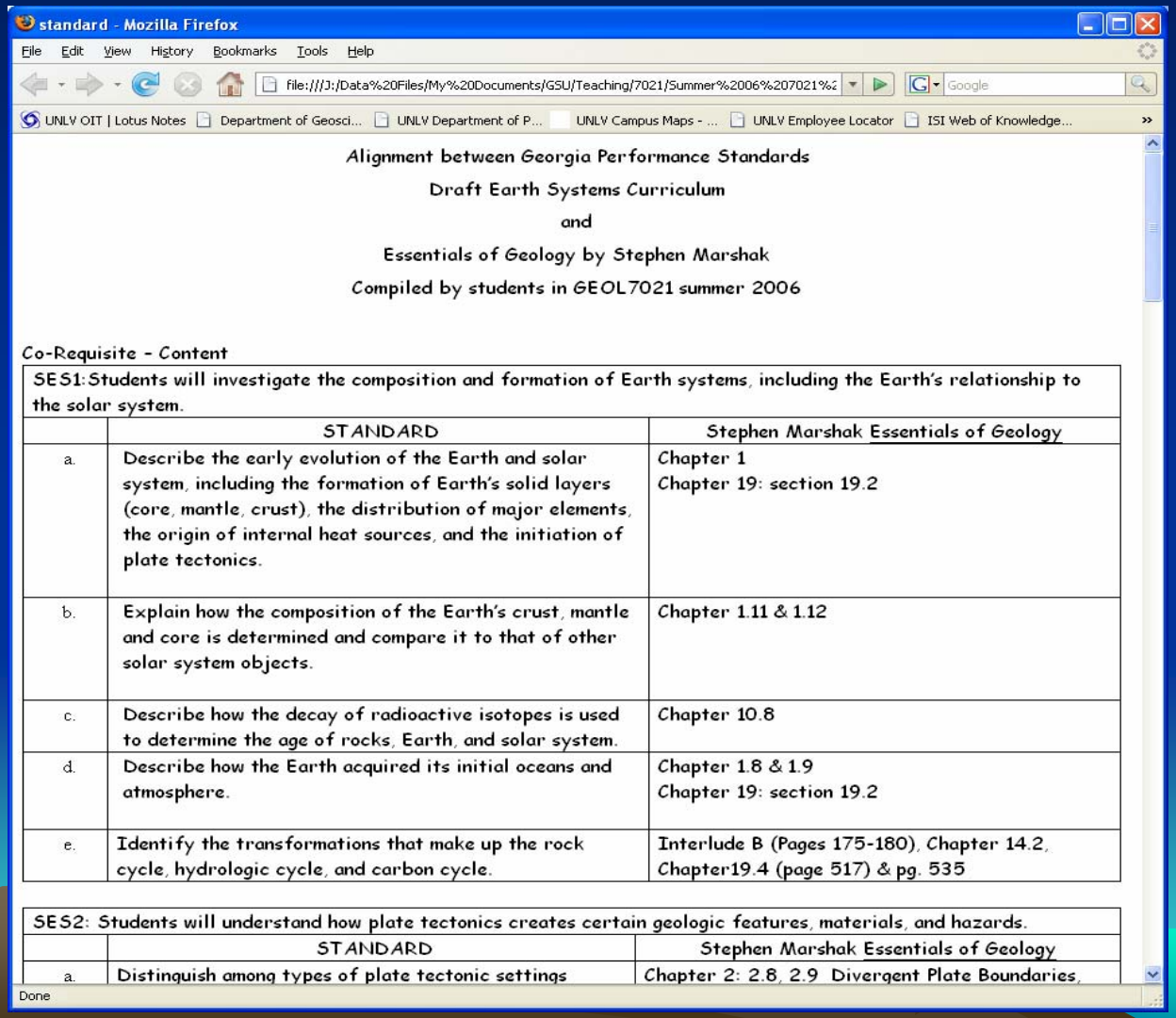
- Topographic maps very abstract
- Paper activities can't reach all students
- Activity
  - Make mountain
  - Trace water levels
  - Draw map
  - Draw cross section
  - Proceed to paper activity

Science Standards

- National Science Education Standards
  - Established by National Research Council
  - Guidelines for what students should know
  - Constructivist approach
- State standards
- Connections to course content



Standards and Course Content



Alignment between Georgia Performance Standards

Draft Earth Systems Curriculum

and

Essentials of Geology by Stephen Marshak

Compiled by students in GEOL7021 summer 2006

Co-Requisite - Content

SES1: Students will investigate the composition and formation of Earth systems, including the Earth's relationship to the solar system.		
	STANDARD	Stephen Marshak Essentials of Geology
a.	Describe the early evolution of the Earth and solar system, including the formation of Earth's solid layers (core, mantle, crust), the distribution of major elements, the origin of internal heat sources, and the initiation of plate tectonics.	Chapter 1 Chapter 19: section 19.2
b.	Explain how the composition of the Earth's crust, mantle and core is determined and compare it to that of other solar system objects.	Chapter 1.11 & 1.12
c.	Describe how the decay of radioactive isotopes is used to determine the age of rocks, Earth, and solar system.	Chapter 10.8
d.	Describe how the Earth acquired its initial oceans and atmosphere.	Chapter 1.8 & 1.9 Chapter 19: section 19.2
e.	Identify the transformations that make up the rock cycle, hydrologic cycle, and carbon cycle.	Interlude B (Pages 175-180), Chapter 14.2, Chapter19.4 (page 517) & pg. 535

SES2: Students will understand how plate tectonics creates certain geologic features, materials, and hazards.		
	STANDARD	Stephen Marshak Essentials of Geology
a.	Distinguish among types of plate tectonic settings	Chapter 2: 2.8, 2.9 Divergent Plate Boundaries,

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SCALE

- Systemwide Change for All Learners and Educators
- Week-long institute for grade-specific earth science topics for in-service teachers at LAUSD
- Five essential features of inquiry

Overarching Institute Outcomes

As a result of participating in this 1Šweek institute, participants will

- implement the FOSS Water Planet and supplements from the Weather Forces and Prediction Immersion Unit in their classrooms,
- understand the CA 5th grade Science Content and I&E Standards and Frameworks that students learn in the units
- develop the abilities to teach the units using the instructional model, conceptual flow, and inquiry framework designed in the unit,
- develop an understanding of inquiry as described by the five Essential Features of inquiry as defined by the *National Science Education Standards*,
- develop an implementation plan for teaching the units that is aligned with the instructional guide and periodic assessment.

Evidence that participants reached the intended outcomes

As a result of participating in the 1-week institute, participants will be able to effectively

- identify the points during the units at which key concepts are introduced, practiced, and applied,
- apply their understanding of the rationale for the conceptual flow, instructional model, and inquiry in the units to implement the units as designed,
- attend a follow up session bringing timely implementation questions and student work samples to share with colleagues and facilitators as part of a larger learning community,

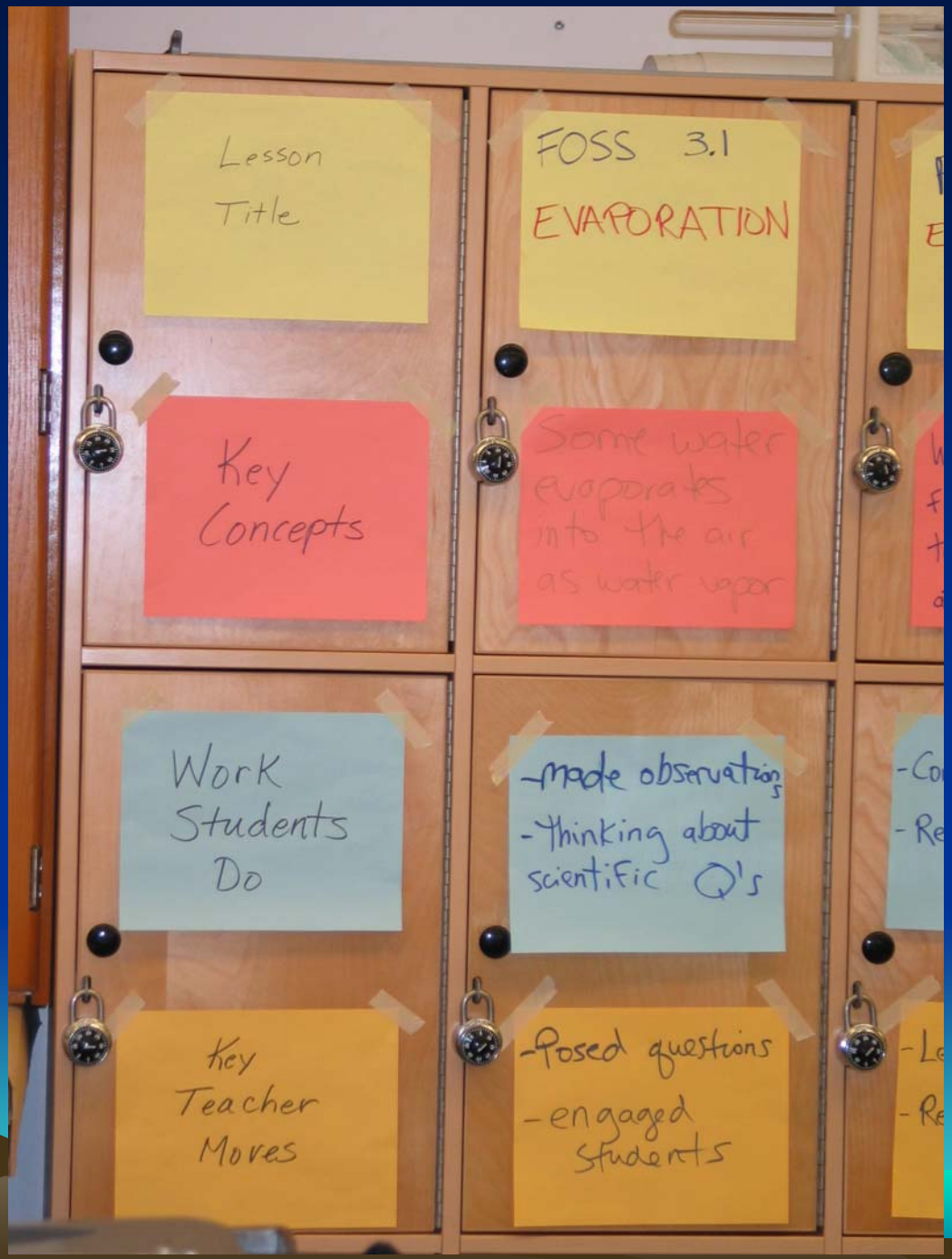
develop a personal planning timeline that explicitly shows when the units will be taught in the next school year

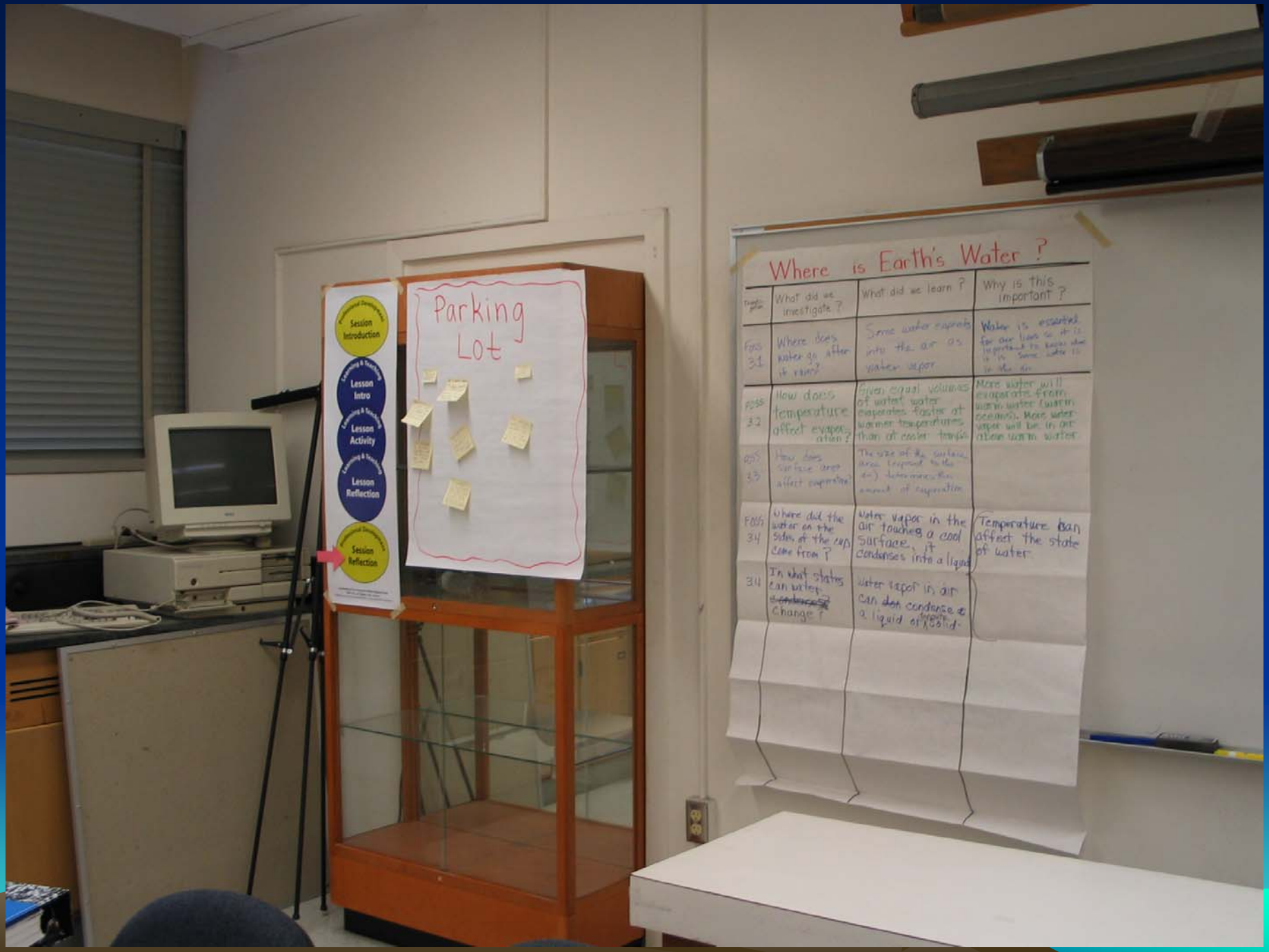
Time	Purpose	Activities	Materials
• **1:05-2:30** 	Model effective teacher moves for supporting data analysis.	Implement Lesson **IU 2.1** as designed and written in the Immersion Unit Implementation Guide.n (Elizabeth) Implement Lesson and **IU 2.2** as designed and written in the Immersion Unit Implementation Guide. (Diana)	Lesson 2.1 materials Lesson 2.2 materials
• **2:30-2:45** 	Discuss challenges and solutions for facilitating data analysis.	Use a Think-Pair-Share to create a t-chart of teacher moves and effects on learners in these lessons. Ask teachers to record in their colored paper what they think will be most challenging about facilitating data analysis. Attempt to have other participants provide solutions. Facilitators can use experiences teaching these lessons with LA students (Jackie).	"Challenges & Solutions" Chart Materials for Wall
• **2:45-2:50** 	Reflect on conceptual flow and possibilities for integration.	Begin the **TeacherWall** and explain its structure and purpose. Walk participants through the Wall columns. Focusing on key concepts and purpose of the lessons. Discuss the time constraints and the low emphasis of the Solar System and I&E standards on the assessments. Generate a class chart of ideas participants have for minimizing the time spent on these standards (e.g., do Swingers during first week of school, address the solar system standards in Open Court Unit 2 --Unit Opener activity?). (Diana)	Pre-made Teacher Wall for Investigation 1 posted on wall and a typed handout

2:50-3:00 Wrap-up

Time	Purpose	Activities	Materials
• **2:50-3:00** 	To wrap-up the day, formatively assess participants, and prepare for tomorrow.	"Gots 'n Needs" Remind about snacks Introduce and explain the "Gots and Needs"—a formative assessment tool for facilitators and have participants complete a post-it for each. Review start time for Tuesday, share that tomorrow we begin by reviewing their "Gots and Needs". Remind about snacks.	"Gots 'n Needs" chart Sticky Notes Snack sign-up


MAP
SCALE
Lesson Title
Key Concepts
Work Students Do
Key Teacher Moves
FOSS 3.1 EVAPORATION
-made observations
-thinking about scientific Q's
-Posed questions
-engaged students
FOSS 3.2 EVAPORATION LOCATION
Water evaporates faster at warm temperatures than at cooler ones
-Conduct investigations
-Record data
-Lead discussion
-Reinforce vocabulary
FOSS 3.3 SURFACE AREA
-Conduct investigations
-Record data
Analyze data
-Review variables
-Review controlled experiment
Parts systems
FOSS 3.4 CONDENSATION
-Select tools
-Make quantitative observations
-Record data
-Make inferences
-Lead discussion
What concerns do you have about your students succeeding at these lessons?
inclusion
timely re-teaching
absences/pull-outs
lack of prior knowledge
variety of assessments
time for science
differentiation
materials
CSUN I MC


Lesson Title
FOSS 3.1
EVAPORATION
Key Concepts
Some water evaporates into the air as water vapor
Work Students Do
-made observations
-thinking about scientific Q's
Key Teacher Moves
-posed questions
-engaged students


Session Introduction
Lesson Intro
Lesson Activity
Lesson Reflection
Session Reflection
Parking Lot
Where is Earth's Water ?
What did we investigate ?
What did we learn ?
Why is this important ?
Where does water go after it rains?
How does temperature affect evaporation?
How does surface area affect evaporation?
Where did the water on the sides of the cup come from ?
In what states can water ~~condense~~ Change ?
Some water expands into the air as water vapor
Given equal volumes of water, water evaporates faster at warmer temperatures than at cooler temps.
The size of the surface area (exposed to the air) determines the amount of evaporation
Water vapor in the air touches a cool surface, it condenses into a liquid
Water vapor in air can ~~don~~ condense a liquid or (solid)
Water is essential for our lives so it is important to know where it is. Some water is in the air.
More water will evaporate from warm water (warm oceans). More water vapor will be in the air from warm water
Temperature can affect the state of water


Parking
Lot


Lesson Title
FOSS 3.1 EVAPORATION
FOSS 3.3 SURFACE AREA
FOSS 3.4 CONDENSATION
FOSS 5.1 WATER CYCLE
WEATHER 1.1 What is weather?
WEATHER 1.3 How do we investigate Severe weather?
WEATHER 2.1 Where does severe weather happen?
Key Concepts
Work Students Do
Key Teacher Moves
Predominant Features of Inquiry
1,2,3,5

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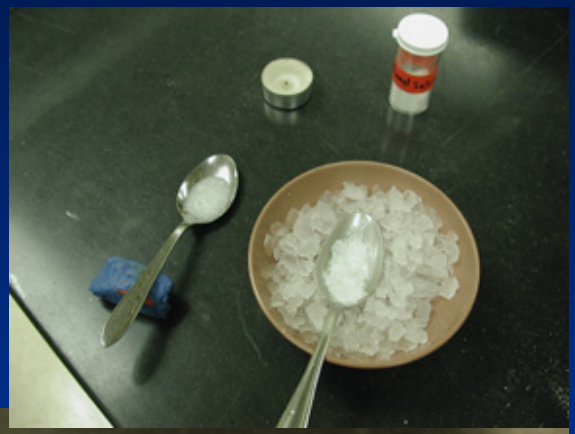
Examples of Hands on Activities



(Hall-Wallace, 1998; JGE, v. 46, p. 439-449)

Example of Inquiry

- Play around a little
- Predict what will happen when it rains
- Spray mist on diatomaceous earth
- Make picture/describe what did happen
- Compare prediction and result
- Repeat

Tomorrow's Scientist: Earth Science

- Spring 2005: 1-unit course (ESCI 300 Lab)
- 4-week Monday program - instructed by Nagy-Shadman
- 4-week Wednesday program - instructed by Simila
- Each program:
  - 24 CSUN students and 24 6th grade students from Patrick-Henry Middle School (LAUSD)
  - 1.5 hour lessons instructed in two class-rooms by six CSUN students

California Science Standards

Standard 1a (Grade 6) - PLATE TECTONICS

Students know evidence for plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and midocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.

Standard 1a (Grade 6)
PLATE TECTONICS

Puzzle-piece fitting of continents

- Chocolate bars broken into 7 pieces

Web worksheet (plate tectonics)

- http://library.thinkquest.org/27026

Label diagram of earth's layers

- Hardboiled eggs

BINGO

California Science Standards

Standard 4c (Grade 7) - SEDIMENTARY ROCKS

Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.

Standard 4c (Grade 7)
SEDIMENTARY ROCKS

Clay models of different kinds of layered rocks
Food models, too! (crackers, cheese, ham)

- sandstone vs. conglomerate

Rock cycle worksheet

Games

- Word search puzzle
- Jeopardy
- BINGO

California Science Standards

Standard 1d (Grade 6) - EARTHQUAKES AND VOLCANOES

Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.

Standard 1d (Grade 6) EARTHQUAKES AND VOLCANOES

- Volcano model
  - baking soda, colored vinegar, soap
- Earthquake demos
  - slinky waves, bending chopsticks
- Games
  - Crossword puzzle
  - Jeopardy
  - Word search

California Science Standards

Standard 2b (Grade 6) - RIVERS, SEDIMENT, AND EROSION

Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natuiral and recurring patterns

Standard 2b (Grade 6) RIVERS, SEDIMENT, AND EROSION

Wave tank

- examined shoreline processes

Stream tables

- examined river formation

Games

- Word scramble
- BINGO

B I N G O

EROSION	RIVERS	SEDIMENT	WIND	GLACIERS
WAVES	DELTAS	SAND	KALPANA	ROCK
WATER	ICE	WEATHERING	LANDSLIDES	MOUTH
SHEENA	SHORELINE	SOIL	STREAMS	WAVE TANK
DEPOSITION	OCEAN	ERODE	STREAM TABLE	RITA

LEARNING GOAL

Students should become familiar with the nature of science (NOS)

i.e., how scientific knowledge develops

Agree? Disagree? WHY OR WHY NOT?

There is a single scientific method agreed upon and used by those involved in science.

There is no such thing as a single scientific method.

Agree? Disagree? WHY OR WHY NOT?

Because science is based on evidence, it can be used to answer any question.

Science and its methods cannot answer all questions.

Agree? Disagree? WHY OR WHY NOT?

Imagination and creativity play a significant role in the work of a scientist.

Scientific activity requires both being logical/systematic and creative/imaginative.

Agree? Disagree? WHY OR WHY NOT?

Scientific laws and theories are open to debate and can be changed.

Scientific knowledge is durable but tentative.

Agree? Disagree? WHY OR WHY NOT?

Because science is based on fact, bias does not play a significant role in scientific activities.

Because of social, historical, and cultural influences, science can be subjective and have bias.

ACTIVITY

Place students in groups of about four

Roles: facilitator, recorder, presenter, materials manager

RESULTS

Each group will use the same "pieces of evidence" in different ways

Each group will adjust their story based upon new evidence

Emphasize to students…

This is analogous to the development and advancement of a theory

For example, the theory of plate tectonics changes as new evidence is collected

ASSESSMENT

In the past, people believed that the sun and planets of our solar system revolved around the earth. Today we know that the sun is at the center of our solar system. Choose one of the Nature of Science tenets to explain how this change in our understanding of the solar system illustrates how scientific knowledge develops.

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Portfolios and Alternative Assessments

- Alternative assessments
  - Strongly favored by education establishment
  - Examples
  - Grading rubrics
- Portfolios
  - As an assembly of alternative assessments for a class
  - Student's demonstration of competence for graduation
  - Program evaluation

Examples of Alternative Assessments

- Burning questions journal
- Crystal growing experiments
- Scrapbook
- Writing a children's book

Earth Science Scrapbook Assignment

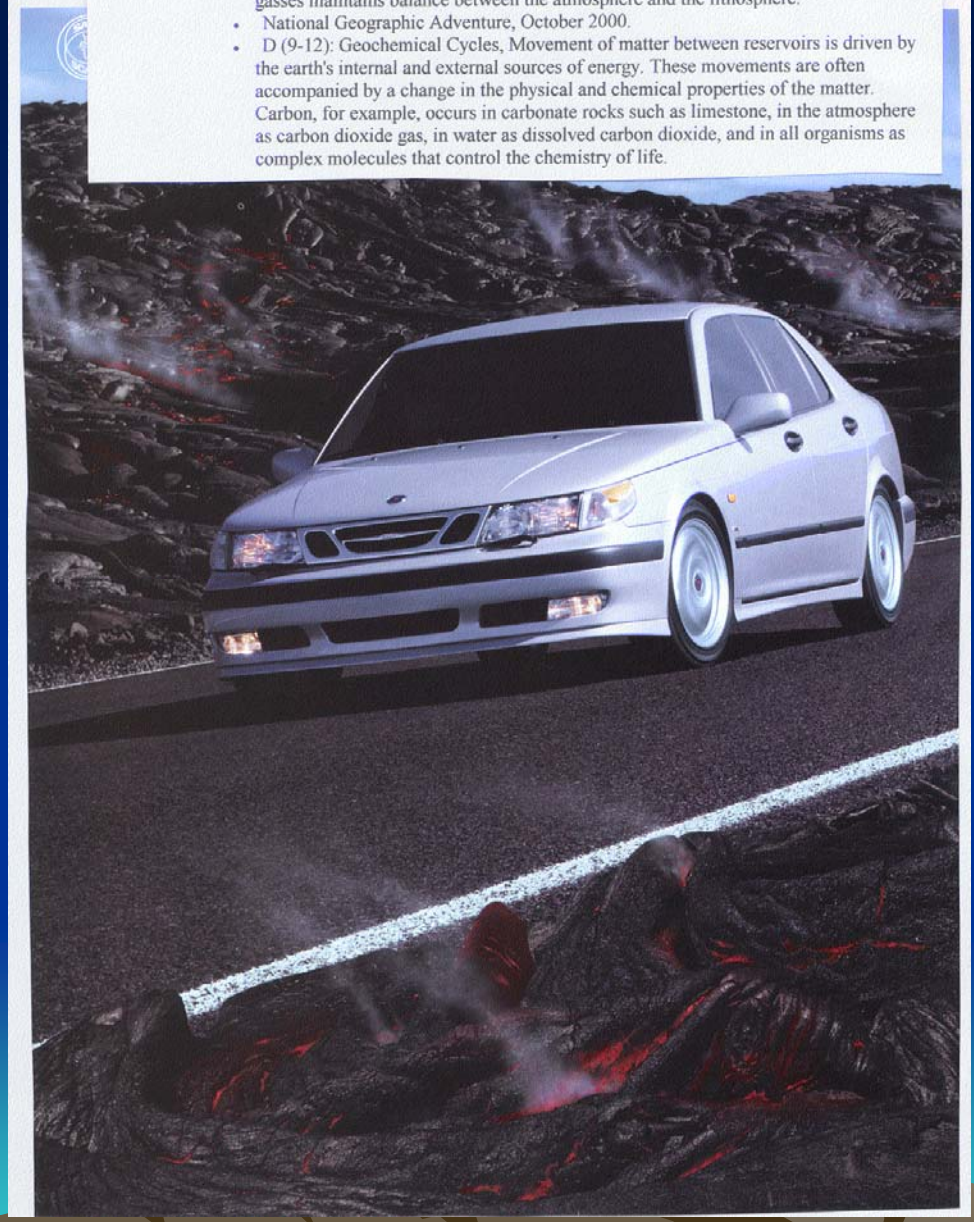
- Items are collected over course of semester
- Can use adds, news articles, postcards, travel brochures, etc.
- Items come from diverse sources
- Items relate to a range of topics
- Student writes a caption for each item

Captions

- Describes connection between item and course content
- Contains content information unfamiliar to student prior to taking class
- Identifies connection to a National Science Education Standards Earth Science content standard (optional)
- Evaluated based on correctness and sophistication
- Iterates through 1st and 2nd draft

Caption 25.

- As lava cools, trapped gasses are released into the atmosphere. The recycling of gasses maintains balance between the atmosphere and the lithosphere.
- National Geographic Adventure, October 2000.
- D (9-12): Geochemical Cycles, Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.



22. Tibetan mountain valley showing typical V-shaped valley.

Outdoor Photographer, Aug 1999

NSES D (9-12) Energy in the Earth System. "Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds, (rain) and ocean currents."

5 Rating: A number of related concepts or a single concept with several sub-concepts, unfamiliar to lay persons are illustrated.	**4 Rating:** Some concepts are missing, but most concepts are unfamiliar to a lay person.	**2-3 Rating:** Few science concepts are discussed or illustrated, concepts would be familiar to a lay person.	**0-1 Rating:** No Science concepts are included.
5 Rating: Book is at the proper cognitive level for middle school.	**4 Rating:** Mainly a children's book but some parts is at too high of a cognitive level for middle school.	**2-3 Rating:** Partially a children's book but much of it is at too high or too low of a cognitive level for middle school.	**0-1 Rating:** Almost none of it is a children's book. It is mostly at too high or too low of a cognitive level for middle school.
5 Rating: The book has a story line that is original and easy to follow.	**4 Rating:** Most of the story line is original and easy to follow.	**2-3 Rating:** Only some of the story is original or story line is disconnected/didn't make sense.	**0-1 Rating:** None of the story is original or there is no clear story line.
5 Rating: Original illustrations convey information/illustrate concepts and add to the book's ability to teach.	**4 Rating:** Original illustrations convey information/illustrate concepts in the book	**2-3 Rating:** All illustrations are original and not copied from books or the Web but are related to the story only in a superficial way.	**0-1 Rating:** None of the illustrations are original or illustrations are not related to story.

Analytical Rubric for Earth Science Scrapbook- Total 25 points

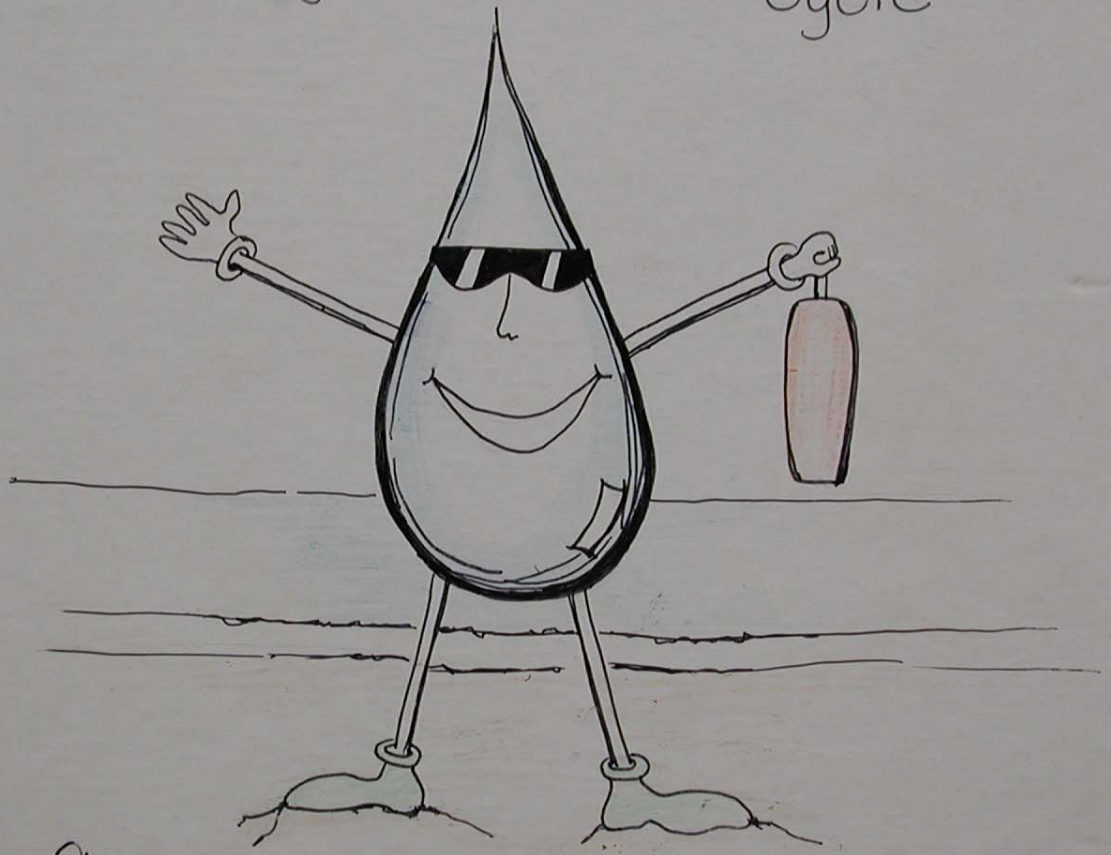
	Best	Good	Passing
# captioned items (15%)	10	8	6
Variety (15%) **(also see comments below)**	at least 3 topics* 4 or more sources* a mix of pictures and news stories or articles	at least 2 topics* at least 3 sources* heavily articles or news stories; only pictures	at least 2 topics* at least 2 sources* all articles or news stories
Content: % correct (25%)	> 90%	> 70%	> 50%
Quality of content (35%)	Earth science content information unfamiliar to lay persons is applied to each item, in many cases caption includes information about geologic processes. Caption is in student's own words and it is clear that ideas have not been cribbed from item's source.	Earth science content information unfamiliar to lay persons is applied to each item, in some cases caption includes information about geologic processes. Caption is in student's own words.	Two thirds of the captions include Earth science content information unfamiliar to lay persons. Caption is in student's own words.
Professionalism of presentation (10%)	Items are neat and aesthetically presented, organized by topic, captions typed, all items are fully referenced.	Items are neat, most items are referenced, captions are typed.	Captions are legible, most items are referenced, some items missing parts of references.

Done

Children's Book

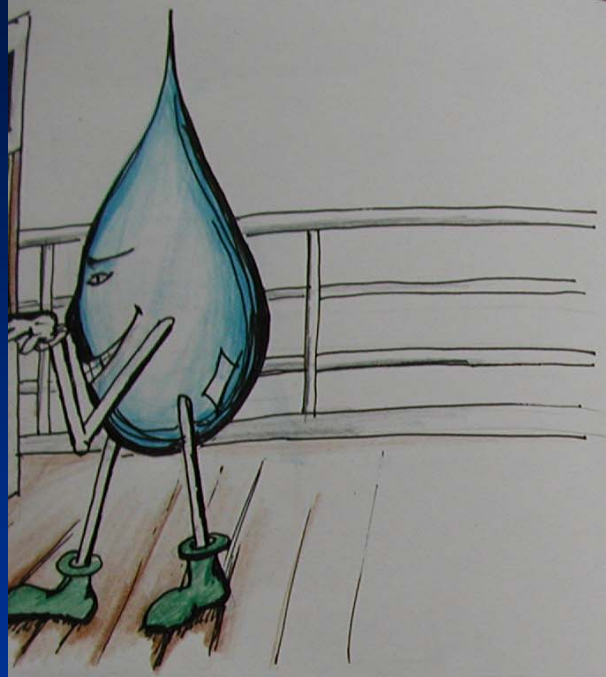
- Student writes an illustrates a children's book
- Book contains science content
- Emphasis on putting ideas in their own words
- Iterates through 1st and 2nd draft
- Evaluated on sophistication and correctness of concepts

Riley's Wild & Crazy Vacation through the Water Cycle



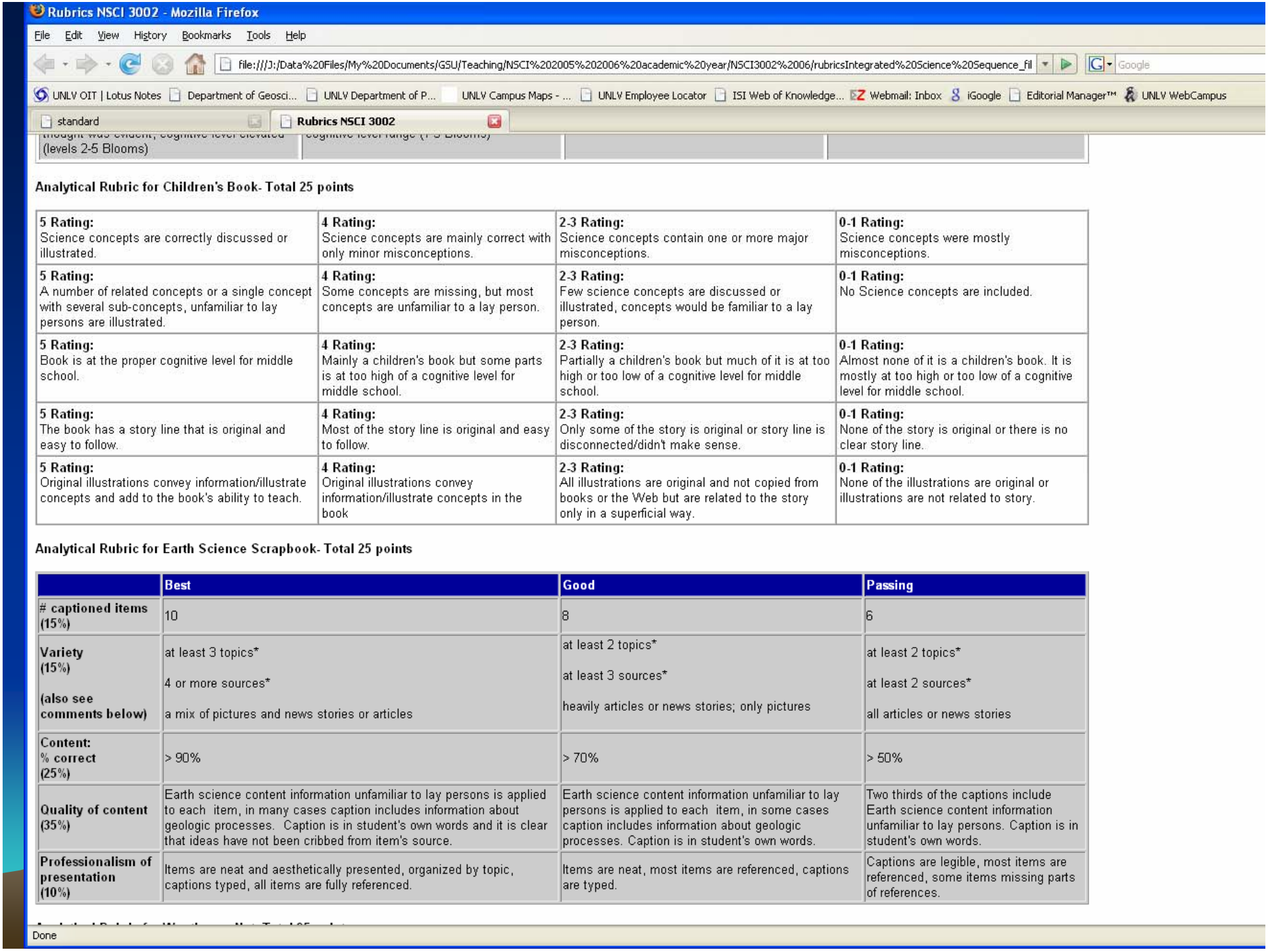
Story by Erica Wooldridge

Illustrations by Greg Watford



"My wonderful relaxing vacation
nk about how I can get home."
s him that since he is in the
rough the roots of a plant or
s using a method called

Riley is not very familiar with transpiration because he usually hangs out in the surface water and evaporates his way home. He did not think about going home a different way just because he was in groundwater. So, he shuts the door, crosses his fingers, and steps on to the platform. Before he can say 'transpiration,' he is back home! He was shot straight up the roots of a tree and disappeared right out of the leaves! "That was so much fun!" exclaimed Riley!



(levels 2-5 Blooms)			

Analytical Rubric for Children's Book- Total 25 points

5 Rating: Science concepts are correctly discussed or illustrated.	**4 Rating:** Science concepts are mainly correct with only minor misconceptions.	**2-3 Rating:** Science concepts contain one or more major misconceptions.	**0-1 Rating:** Science concepts were mostly misconceptions.
5 Rating: A number of related concepts or a single concept with several sub-concepts, unfamiliar to lay persons are illustrated.	**4 Rating:** Some concepts are missing, but most concepts are unfamiliar to a lay person.	**2-3 Rating:** Few science concepts are discussed or illustrated, concepts would be familiar to a lay person.	**0-1 Rating:** No Science concepts are included.
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