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Language-Rich Inquiry-based Science with English Language Learners (LISELL)

Overview

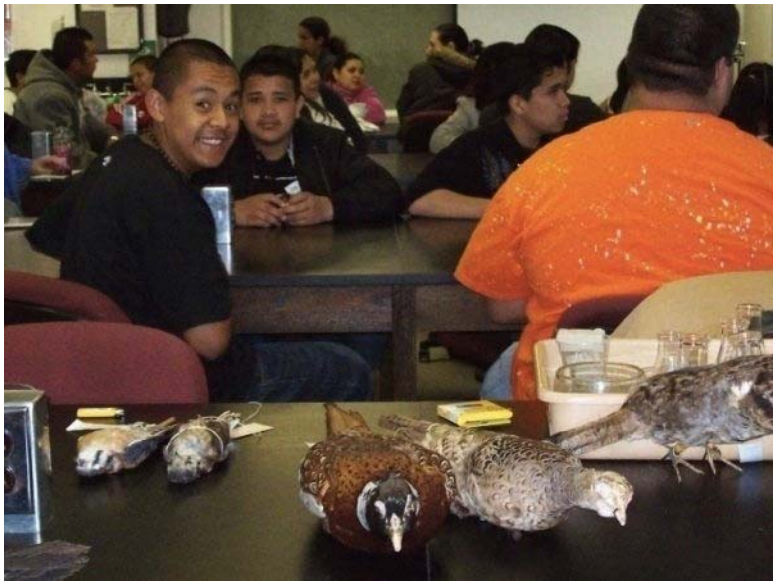
- 4th year of project funded by NSF, USDoE & HSF
- Overarching goal is to develop a model of language-rich science inquiry teaching and instruments for evaluating that model
- Focus is on middle school ELL students, their families and their science and ESOL teachers

Model

- The LISELL model connects science inquiry practices with a focus on academic language
- LISELL science inquiry practices: Coordinating Hypothesis, Observation & Evidence; Control of Variables; and Cause & Effect Relationships
- LISELL academic language practices: Using General Academic Vocabulary in Context; Function of Academic Language of Science

Contexts

- Middle school science classrooms (Grand Rounds)
- Teacher PD workshops
- Family workshops
- Scoring Saturdays



Overview: Science Inquiry Practices

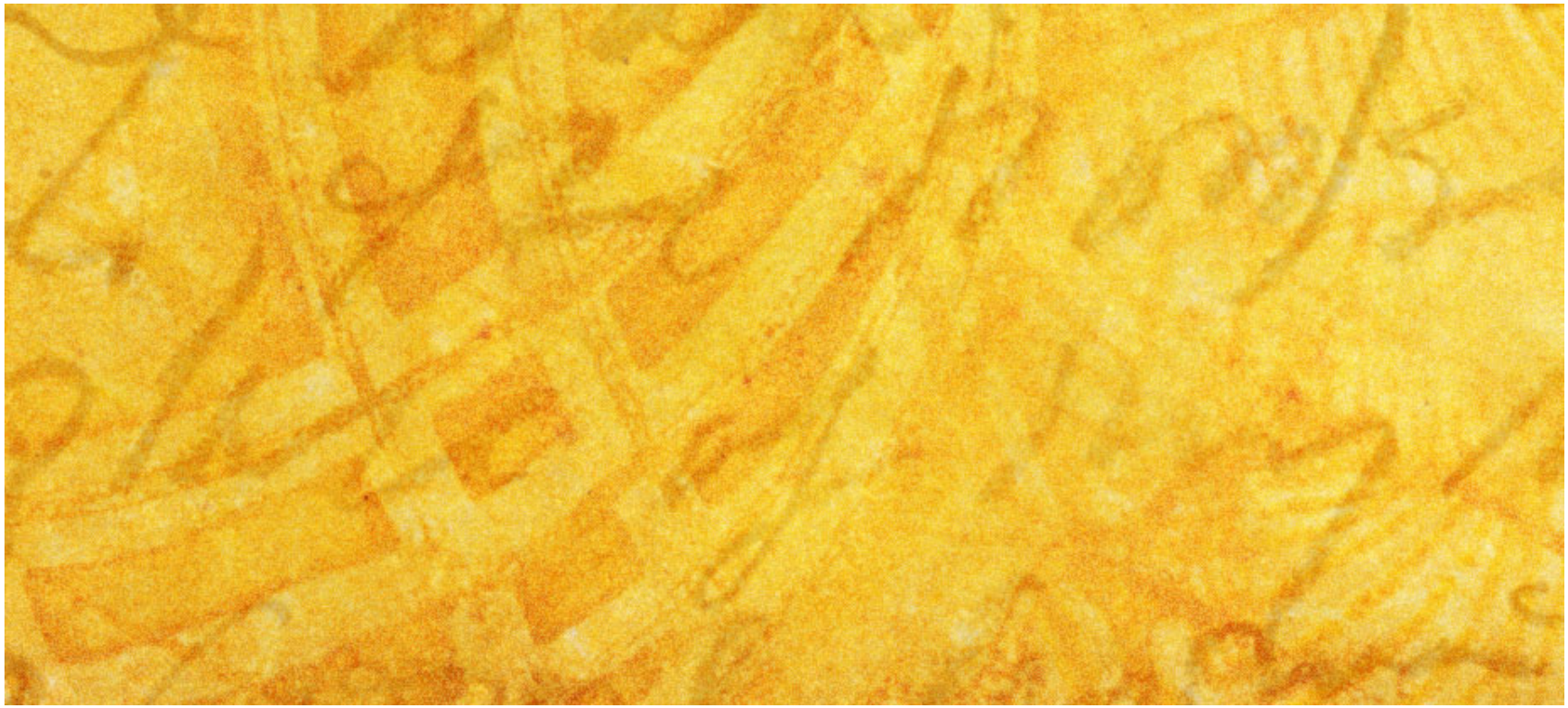
- These practices are important across the science disciplines
- They are challenging but accessible for middle schoolers
- They are conducive to developing the skills of thinking, doing, talking, and writing scientifically
- They are strongly connected to the Next Generation Science Standards & Common Core Math & Language Arts Standards

Scientific and Engineering Practices	ELA Student Portraits	Mathematical Practices
1.Asking questions and defining problems 2.Planning and carrying out investigations 3.Analyzing and interpreting data 4.Using computational thinking 5.Constructing explanations and designing solutions 6.Engaging in argument from evidence 7.Obtaining, evaluating, and communicating information	1.Demonstrating independence 2.Building strong content knowledge 3.Responding to the varying demands of audience, task, purpose, and discipline 4.Comprehending as well as critiquing 5.Valuing evidence 6.Using technology and digital media 7.Understanding other perspectives and cultures	1.Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 3.Construct viable arguments and critique the reasoning of others 4.Use appropriate tools strategically 5.Attend to precision 6.Look for and express regularity and patterns

Language Demands for all students, especially for ELLs:

1. Text complexity
   A. Academic language (shared across disciplines)
   B. Multiple modalities (differences among the disciplines)
2. Language functions (commonalities and differences among the disciplines)
3. Participatory structures that create opportunities for student discourse

Using General Academic Vocabulary



Overview: General Academic Vocabulary in Context

- "every day" language (type 1, *block, play*)
- general purpose academic language (type 2, *analysis, benefit*) that cuts across academic content and context
- specialized content-specific language (type 3, *osmosis, biodiversity*)
- We over-emphasize the out-of-context study of type 3 vocabulary, and under-emphasize type 2 vocabulary

Vocabulary and Definitions

Photosynthesis – 2 definitions

- The process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source. (life science textbook)

- How a green plant uses sunlight to change water and carbon dioxide into food for itself. (Wordsmyth.net)

Whole School Vocabulary Project

- Comprehensive method to immerse middle school students in academic vocabulary
- Students need a useful lexicon of words to support their studies and assessments
- Students must see and use these words a minimum of 12-16 times for retention

The Words…

- A blend of words from the Georgia Standards and the Coxhead Academic Word List
- Definitions created by teachers and by Wordsmyth.net

Word of the Day

Previous *(Anterior)*

(adj) Happening, or occurring, before something else

Businesses that hire animal trainers often require previous experience with animals because care and feeding of animals is part of the trainer's responsibility.

The Process…

- Word Walls
- Tasks by Subject
- Edmodo
- Announcements
- School-Wide Recognition

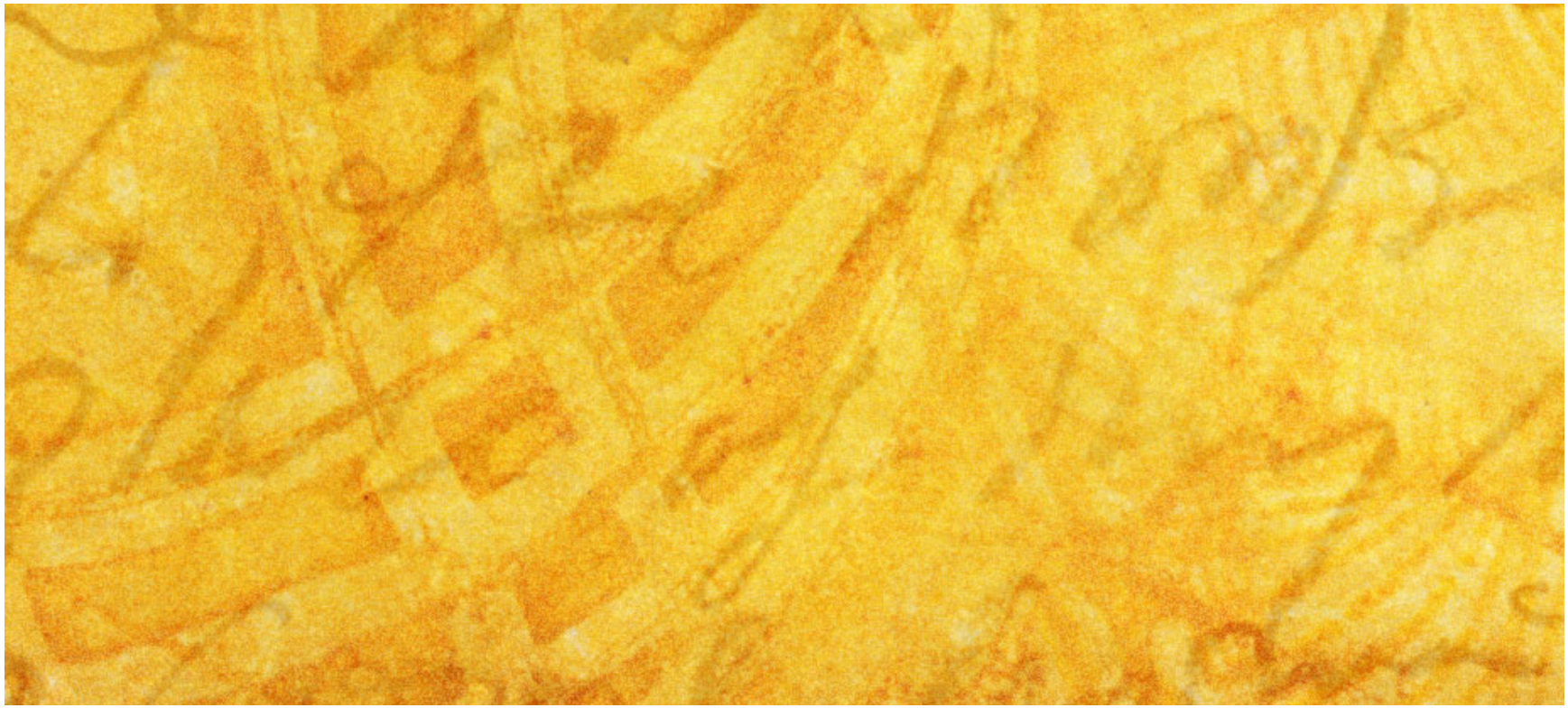
Today's Word: Distinguish *(Distinguir)*

Definition: (v) to tell the difference

Example: Can you **distinguish** between Pepsi and Coke?

Your Job: Write a new sentence using the word **distinguish** and underline the word.

Using the Academic Language of Science



Overview: Function of Academic Language of Science

- Focus on how language functions for specific purposes
- We all use language to create meaning through use of "content," "voice," and "message structure"
- The language of science has unique features that cause many students to struggle

The technical nature of scientific vocabulary

- Specialized words for naming (*genotype*), classifying (*arthropod*), describing (*nocturnal*) and processes (*refraction*)
- Everyday words with specialized meanings (*force, matter, medium*)
- Must be learned & used in context
- Activity A – Roots, Prefixes & Suffixes

Use of abstraction & nominalization

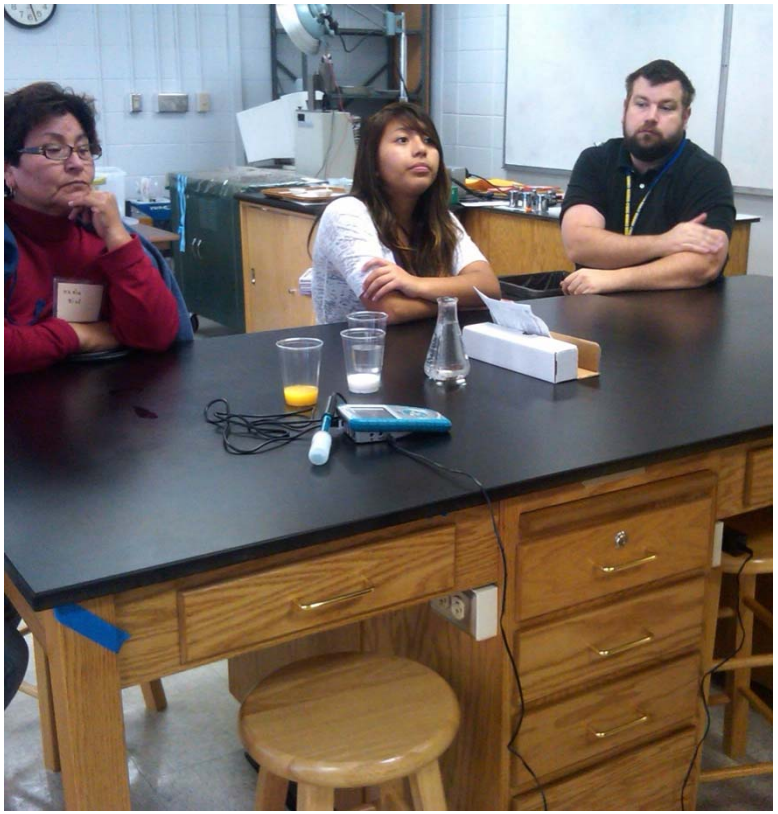
- Processes (verbs) and qualities (adjectives) reframed as nouns
- Distill → distillation or sensitive → sensitivity
- Allows science discourse to create explanations that sound more objective (explicit subject actor is removed)
- Activity B – Rewriting sentences

Use of high-density clauses

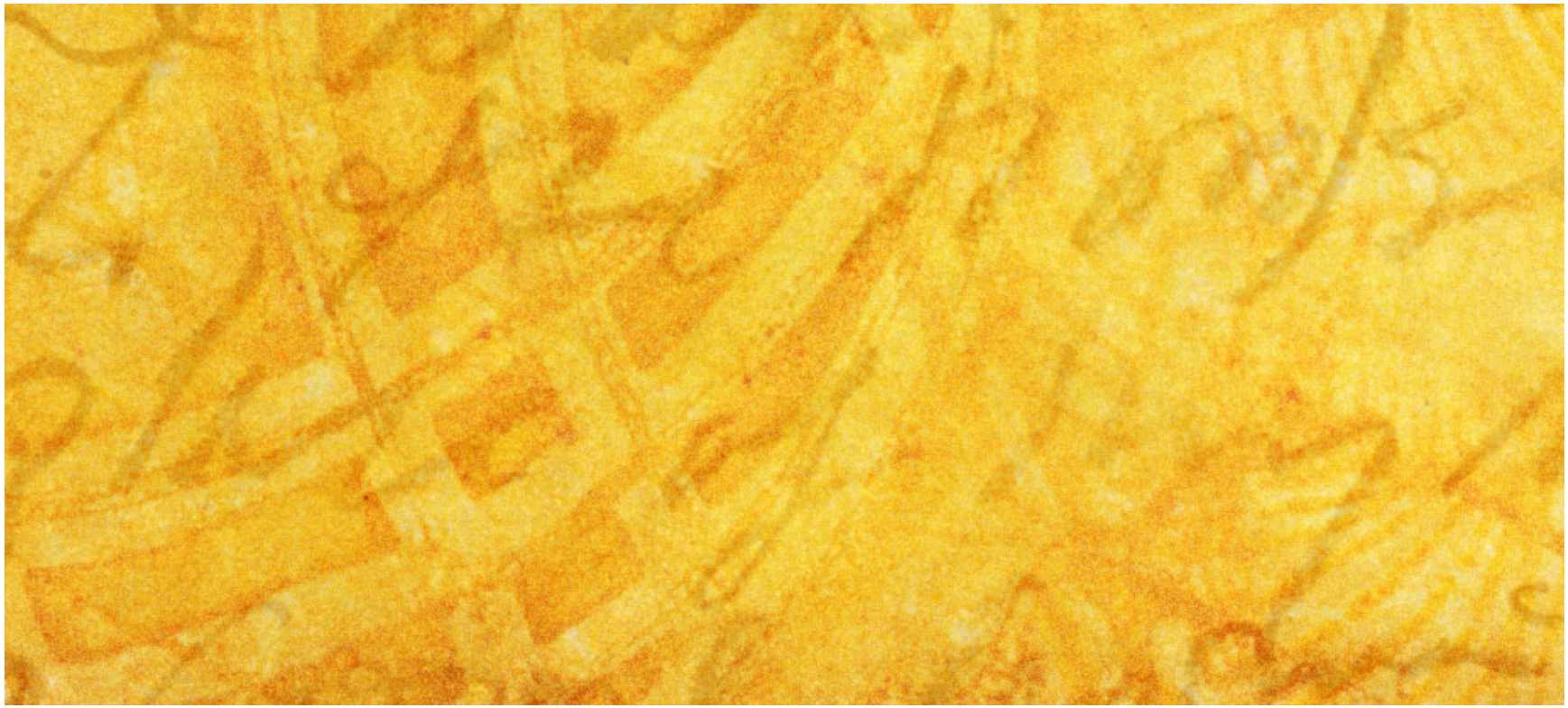
- Clauses in science have high lexical density (number of process, participant and circumstance words per clause)
- Noun groups – simple nouns with multiple pre- and post-modifiers
- Allows science discourse to create densely packed explanations
- Activity C – Collapsing and expanding noun groups

Use of tightly knit structures

- Clauses are composed of Themes & Rhemes - Theme is main idea of clause
- Rheme is remainder of clause where Theme is developed
- Allows science discourse to create tightly knit chains of reasoning
- Activity D – practice saying it another way



Language Rich Science Inquiry



Science & Language Through Inquiry Practices

- Use of lab framework to support language-rich science inquiry practices
- Example using Cartesian Divers

Pre-lab Prep

Question/Pregunta:

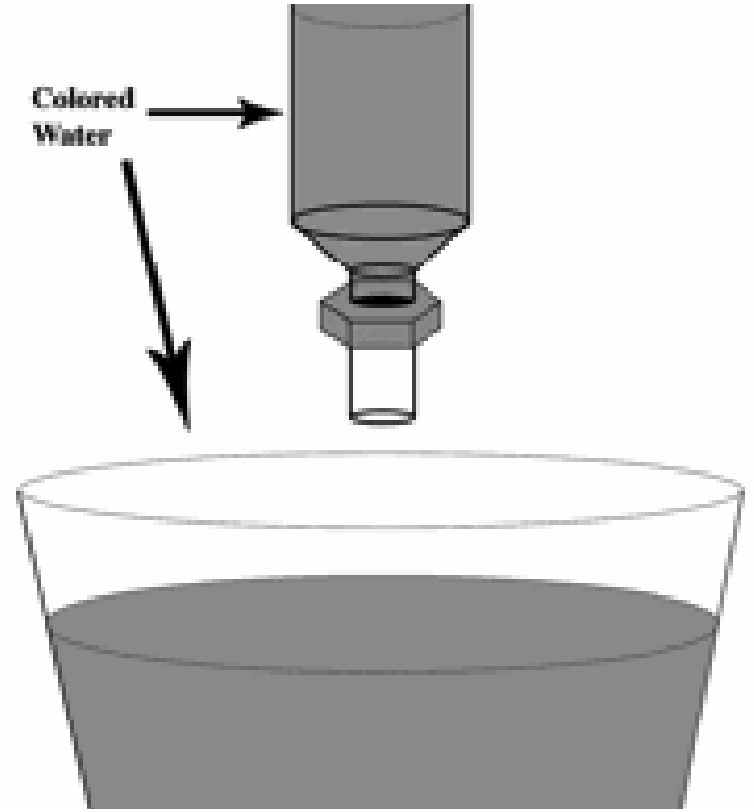
- What are we trying to figure out?
- What is our focus?

controls/variables y controles

- What am I changing in the experiment? (Independent Variable)
- What changes as a result of my change? (Dependent Variable)
- What needs to remain the same throughout the experiment? (Controls)

Hypothesis/Hipótesis

- What do we know previous to the lab?
- If I do this, then what do I think will happen?
- Relate independent variable to dependent variable

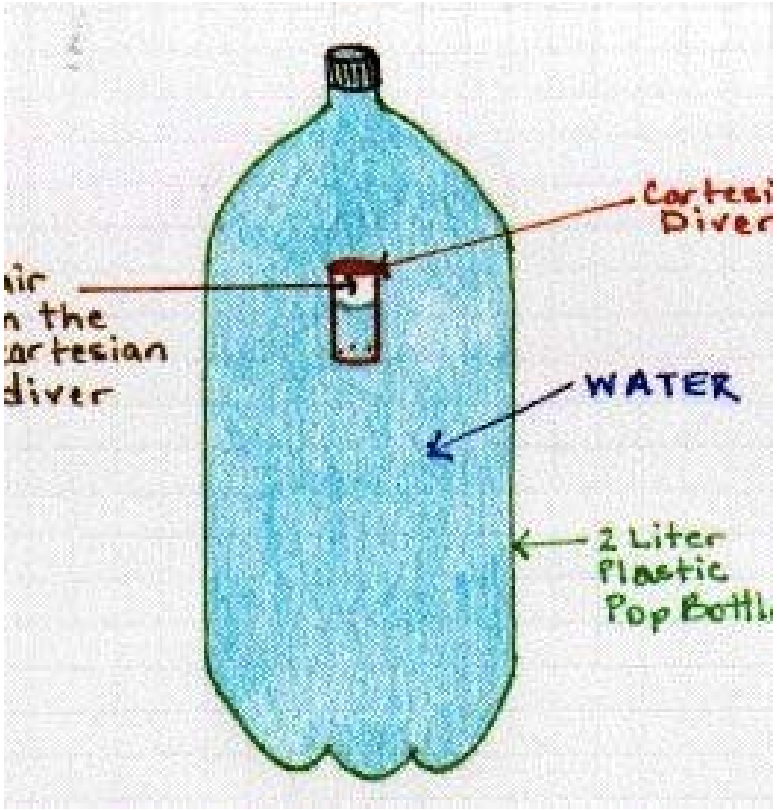


Observations/Observaciones

- What do we see?
- What should we measure? Why? How?
- Can we make connections between what we know and what we see?

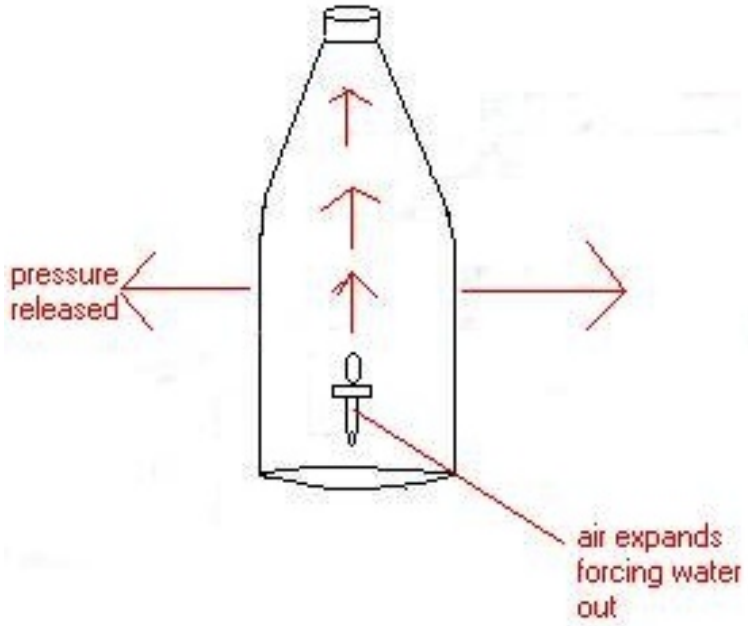
Evidence & Data/ Evidencia y Datos

- What happened?
- Describe what I saw.
- Describe what I measured and why.



Analysis/Análisis

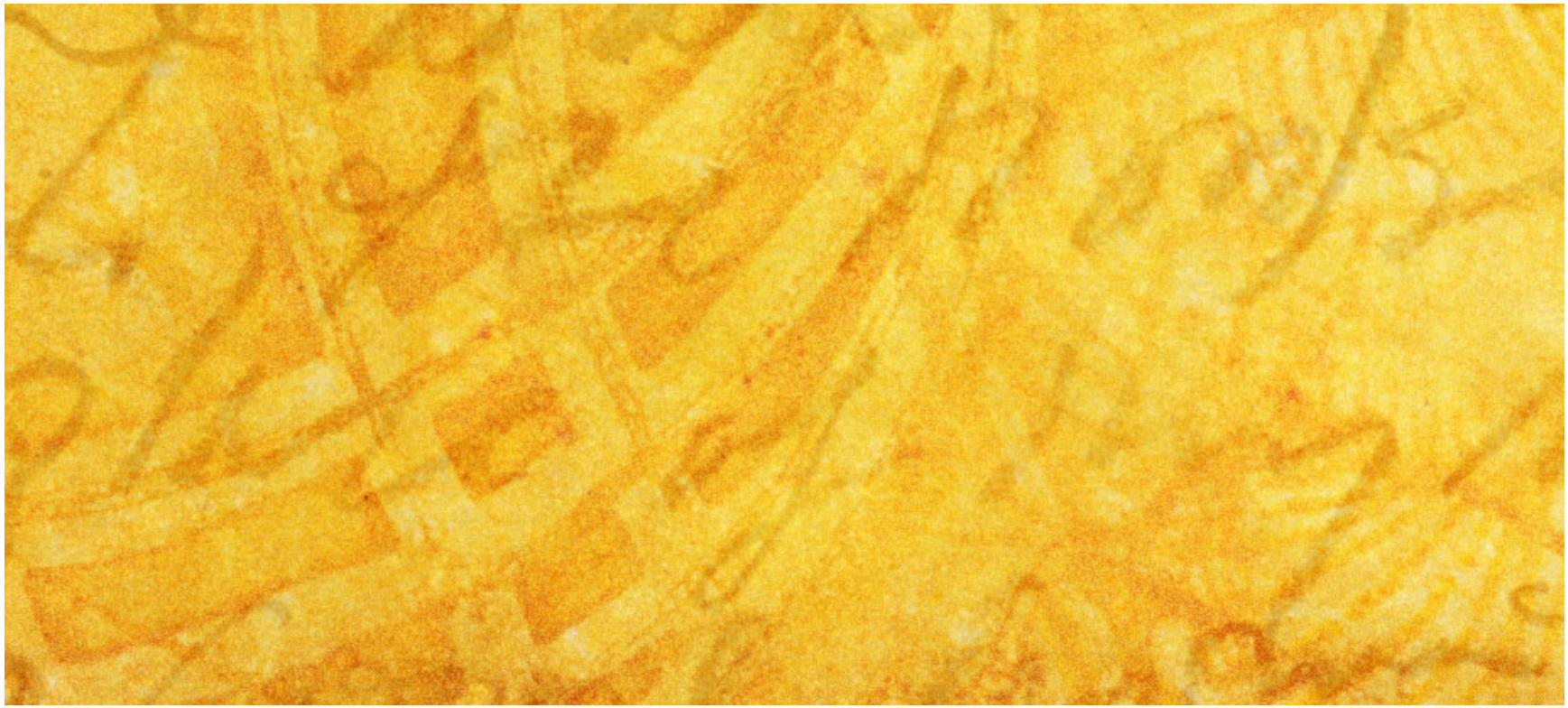
- How do I make sense of my data?
- Do I see any patterns?
- Can I definitely say that one action caused another?



Conclusion/ Conclusión

- Did my hypothesis match what actually happened?
- If not, what did I learn from the experiment?
- What else would I like to try or learn by changing some aspects of the lab?
- What academic language do I need to explain how the diver works?

Wrap-Up and Discussion



Take Home Message

- ELLs will continue to grow as a percentage of our K-12 students
- Cognitive and linguistic demands of the Next Generation Standards will increase
- Science teachers need new models and tools for simultaneously supporting content and language development for all students
- Models like LISELL provide a possible direction forward

Discussion Questions

- How else do you address academic language in your science teaching?
- What other inquiry practices do you use that support science and language learning for ELLs?
- What other questions do you have?