INVERNESS RESEARCH

Partners in Innovation: Integrating ELD and Science

The Exploratorium and Sonoma Valley Unified School District

STUDENT PROGRESSIONS IN SCIENCE AND LANGUAGE DEVELOPMENT

An Introduction and Rationale

"Let's give them science to talk about!" is the motto that emerged from the Integrating ELD (English Language Development) and Science program, a partnership between the Exploratorium and Sonoma Valley Unified School District (SVUSD). The hum and buzz of students asking questions, talking with one another, and moving about as they interact with real and investigable materials are earmarks of the program's classrooms.

Inquiry-based science is widely recognized as a powerful educational approach for inducing children to participate actively in school, to observe and speculate and interrogate, and simultaneously, to generate abundant language needed to express what they are learning about the natural world. "Motivation" and "excitement" are words used frequently by teachers witnessing their students involved with the hands-on phenomena that serve as the core of the program. Scaffolds through questioning, interactions with materials, discussion, and journaling guide their investigations. Students in these inquiry-based classrooms are engaged in active learning that expands both their conceptual understandings and language development.

What Is the Partners in Innovation: Integrating ELD and Science program?

The goal of the Partners in Innovation: Integrating ELD and Science program was to enhance K-5 students' English Language Development and science learning. Over five years the program promoted the implementation of an integrated ELD and science instructional approach by providing concrete supports to teachers in four critical dimensions: curriculum, professional development, professional learning community, and district backing. With its focus on learning language in the context of hands-on science, the program aimed to establish a robust, districtwide elementary science program as well as to accelerate the language development of its English Language Learners.

What is an effective strategy for demonstrating student learning benefits from Integrating ELD and Science?

Despite what observers can infer about the benefits of classrooms rich in science and language experiences, it is challenging to assess and describe learning improvement stemming from an integrated science and language approach. Important student benefits—increasing motivation and confidence to learn, expanding language fluency, building vocabulary and academic language, acquiring process skills and scientific habits of mind, developing conceptual understanding, or learning science content—are all palpably apparent to teachers. But these capacities are not readily revealed on standardized measurements designed to test student achievement. As an alternative, the concept of ***student progressions*** offers a broad and nuanced view of student learning.

What are student progressions?

Rather than a focus on a single outcome that the term "student achievement" implies, the construct of ***student progressions*** emphasizes growth and development of learning over time, illuminating the nature of a steady accumulation of knowledge, skills, and abilities. In addition, rather than relying on a single

measure such as a student's one-time-only responses on a standardized test, ***student progressions*** are tracked through multiple measures of student work, including students' actions, listening, speaking, drawings, and writing. Assessments and evaluations occur through teachers' frequent examination of their students' work and their reflections about what it reveals about their learning.

Over the course of the 2013-14 school year, Inverness Research, in tandem with a group of seven teachers from Sonoma Valley Unified School District, documented, examined, and analyzed the work of 14 focal students, all English Language Learners (ELLs). The cases of ***student progressions*** that evolved serve as exemplars, illustrating how students throughout SVUSD grew in a range of learning dimensions as they participated in the Integrating ELD and Science program.

How does the Integrating ELD and Science program unfold to generate student learning?

A 2nd-3rd grade teacher who had been involved with the program for five years described succinctly how the curriculum units unfold and how the design of the activities promotes student learning. She identified five major phases to each unit:

- ✓ ***First, students tell what they know about a topic, for instance, magnets or shadows. They draw on their existing knowledge and share it with the class.***
- ✓ ***Second, students receive materials that enable them to explore the science topic, perhaps different kinds of magnets or various objects and a light source. They have ample time to play firsthand with the materials, to observe, to experiment, to see how the materials and the science phenomena behave. Students talk with one another and with the teacher in informal, free-flowing ways.***
- ✓ ***The lesson then introduces science terms and vocabulary. After the foundation of students' own investigations with real materials the new, scientific words make sense. Students can attach meaning to these words in terms of what they have experienced. Vocabulary such as "reflection," "straight line," or "light source" now make sense to them.***
- ✓ ***Through Science Talks, students address prompts and questions that offer them opportunities to describe and explain what they have investigated. They listen to and share their thinking with one another, learning new vocabulary, new usage, and new ideas.***
- ✓ ***Students express and apply what they are learning in their Science Journals, either through writing or drawing or both, giving the teacher evidence of what they are thinking and an opportunity to interact with and challenge them. The Science Journal serves as a repository of student knowledge as well as a visible documentation of their growth and development on a particular science topic, which students get to see for themselves as they review their own journal entries.***

What is an example of a student's progression?

The following story of Dawn, compiled and analyzed by her teacher, Ms. Masters, offers glimpses into a year-long learning progression. Although both the name of the student and the teacher are fictitious to maintain anonymity, the actual activities, student work, and teacher comments are drawn exactly from the documentation generated by the examination of focal student work intended to illuminate the nature of ***student progressions***. Centering on writing products, the story describes how a 3rd grader studied snails and shadows, how the teacher studied and reflected

on her student work, and how ultimately Dawn's English Language Development progressed through learning science.

Dawn's story also illuminates the following questions that guided her teacher's thinking: ***What kinds of curricular and instructional experiences could spur Dawn to become more facile with English, more confident in her oral and written communications, and a more confident learner? How could using the Integrating ELD and Science program, adopted by the district and used at this school as the ELD curriculum, stimulate growth in Dawn's language development and science learning? What is the nature of benefits to this student?***

SNAIL STUDY – FALL 2013

At the onset of her work documenting Dawn's learning while participating in Integrating ELD and Science, Ms. Masters wrote a student profile of Dawn. She noted the following about Dawn's arrival to the school and her initial engagement and activity in class and out:

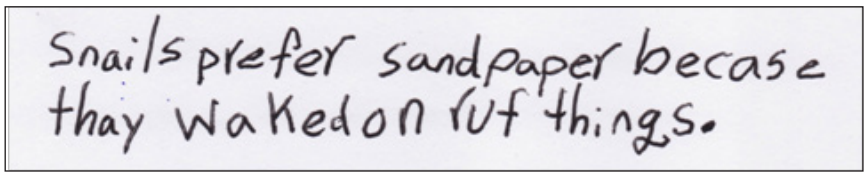
> ***Dawn is a cheerful and kind third grade English Language Learner in the Sonoma Valley Unified School District. She is the youngest child from a small, supportive immigrant family. She arrived at El Verano Elementary School as a "newcomer," enrolled in first grade, was classified as an Early Intermediate English Learner, and received daily assistance through the district's Student Support Team through her third grade year.*** [1]

Dawn's writing is copied from another student, although she is paying adequate attention to the experiment and what others are saying.

~ Ms. Masters

> ***Dawn is extremely quiet and rarely talks in or out of class. She has started to speak a little here and there, but only when asked a direct question. Dawn requires a lot of additional time to complete tasks and answer questions. She adequately pays attention and tries hard to do all her work. Dawn is still a developing reader and has limited vocabulary in both English and Spanish. She doesn't ask for help from the teacher and relies mainly on the help of her classmates.***

During the fall, third-graders at Dawn's school studied snails as part of the Integrating ELD and Science program. Small groups of students investigated questions such as: ***What do snails look like? What do they eat, and how do they move? How do their body parts and their behaviors help snails live in their environment?*** After an inquiry into what kind of surfaces snails prefer, Ms. Masters asked the children to respond to the following writing prompt in their science journal: ***Tell me what you know about which surface snails prefer. Use words and pictures.*** Dawn's written response is below.



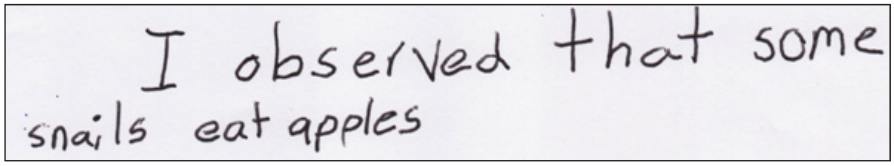
Ms. Masters offered the following encouragement to Dawn in her journal, hoping to elicit just a little more language: ***Good observation. Can you tell me why snails liked rough things like the sandpaper?*** Dawn's answer to the teacher's prompting did not offer much new thinking: "Snails like sandpaper because they are used to the rough."

Ms. Masters noted in her teaching log: ***Dawn's writing is very limited in detail. Though she is writing in complete sentences, with correct usage, capitals and periods, there is no extra information about any of the things that she learned during the snail unit.*** She wondered: ***Perhaps Dawn would benefit***

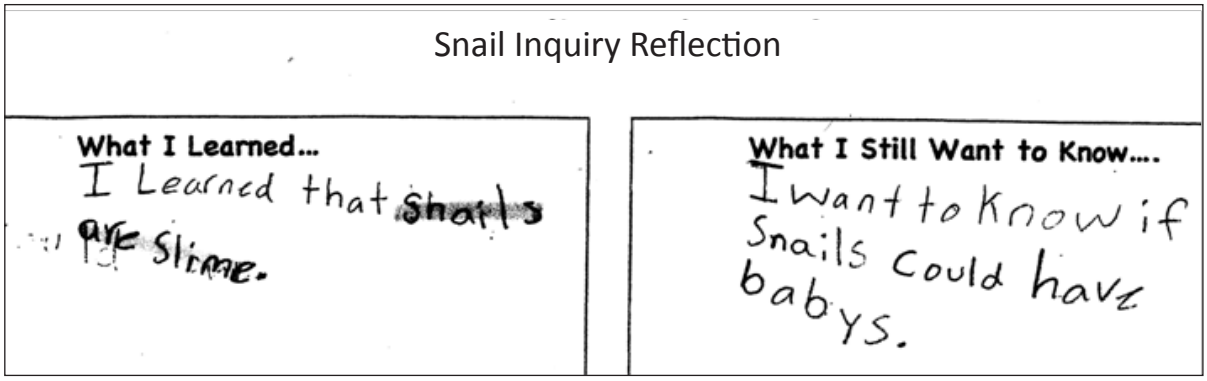
[1] Quotes are taken directly from interview transcripts and edited for both grammatical correctness and readability. The integrity of the quotes has been maintained; intent and meaning have not been altered.

from talking about the answers to the questions before writing them down. But in the same entry, Ms. Masters summarized: ***Since Dawn has such difficulty speaking, her writing is very limited.***

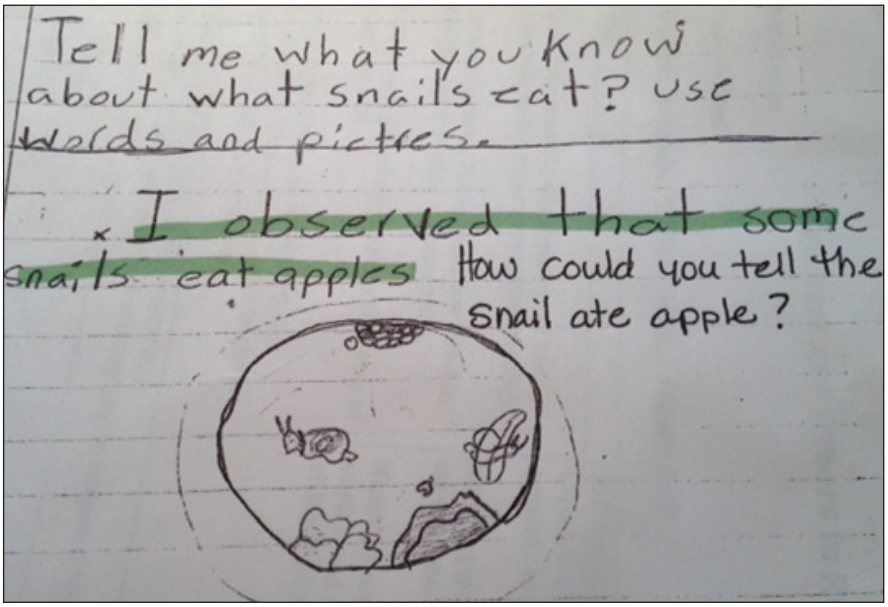
Although Ms. Masters prompted Dawn to tell more in her journal about what snails eat, Dawn's next journal entry again elicited a limited response and gave no new information.



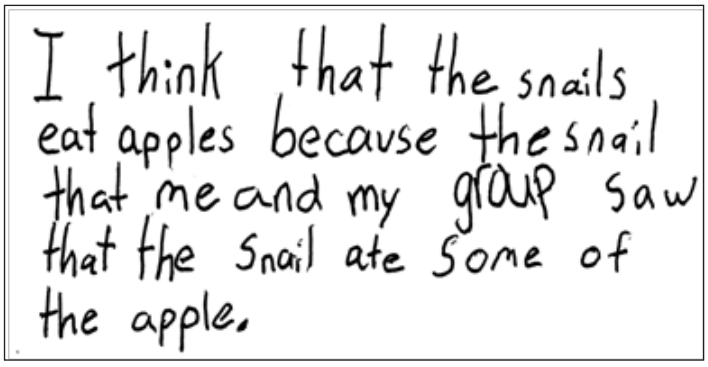
Still later in the fall, toward the end of the snail unit, the teacher asked students to generate a ***Snail Inquiry Reflection***. This time some of Dawn's own thinking found its way onto her paper. The paper shows how she was constructing knowledge. Here she presented two ideas that hadn't appeared in her writing before. These two deceptively simple ideas are an important benchmark, representing Dawn's progression toward engaging with, owning, and internalizing the intellectual process. These two entries reflect the student's <u>own</u> questioning, and her <u>own</u> (what science inquiry pedagogues call) "conversation" with the science phenomena. In turn, Dawn's internal dialogue demanded an outward expression, as shown in her entry below.



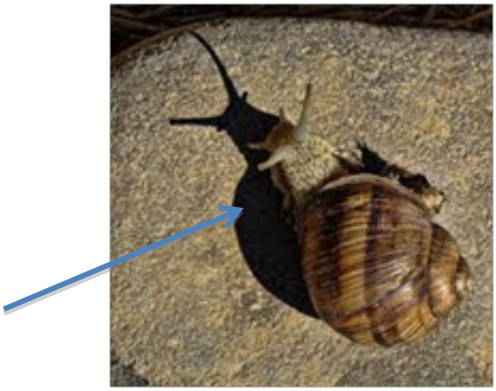
Another indication of the learning progress Dawn was beginning to make is revealed in the following journal entry. In response to the question ***What do snails eat?*** she answered in her typical minimalist mode, but she also drew a picture depicting the snail in its petri dish enclosure, expressing more of what she had observed in her classroom science experiences. She included bits of lettuce and other food as well as some fecal matter deposited by the snail.



Ms. Masters did not allow students to copy from one another for the final written reflection culminating the snail study. So Dawn was left to generate thinking on her own. Though her writing addressed only one science idea about the snail, "Snails eat apples," she did write more than she had previously in any assignment. She had learned to spell "because" correctly. And she acknowledged her work within the group. Even so, Dawn's teacher was disappointed. She had hoped for more progress.


I think that the snails eat apples because the snail that me and my group saw that the snail ate some of the apple.

Dawn's writing demonstrates that she did not understand the writing activity and maybe did not understand the general concepts of the snail unit. Dawn did fill out the worksheet and final writing task to the best of her ability.



Since Dawn has a new partner, she has a chance to speak with someone who actually listens to her and asks her what she thinks.

~ Ms. Masters

SHADOW STUDY — SPRING 2014

Dawn's teacher thought hard about what she could do to engage Dawn more fully and help her ***be more comfortable in her own skin to participate*****.** Mrs. Masters decided to deliberately select the right partner for her to engage with during the science unit on Shadows that the class started in the spring. Rather than working with a group of students, Dawn now had a single partner who was chosen because she would neither speak for her nor ***just let her sit there and do nothing***, but was someone ***who wasn't going to let her get away with not talking at all***.

In the third grade Shadows unit students investigate shadows. They pursue questions such as: ***What is a shadow? How do they work? Why do certain changes in shadows occur? How can you explain shadow changes using the idea that light travels in straight lines?*** A core strategy used by the Integrating ELD and Science program to enable students to make sense of their inquiry and to promote their language is "Science Talk." Reflecting on Dawn's participation in some of the Science Talks she facilitated during the Shadows unit, Ms. Masters wrote these observations in her teacher's log:

- ✓ ***Dawn was speaking to her partner. She was sharing her opinion.***
- ✓ ***When asked, Dawn responded to the teacher in a clear and confident voice.***
- ✓ ***During the Science Talk, Dawn raised her hand several times in a row and shared a comment or a question.***

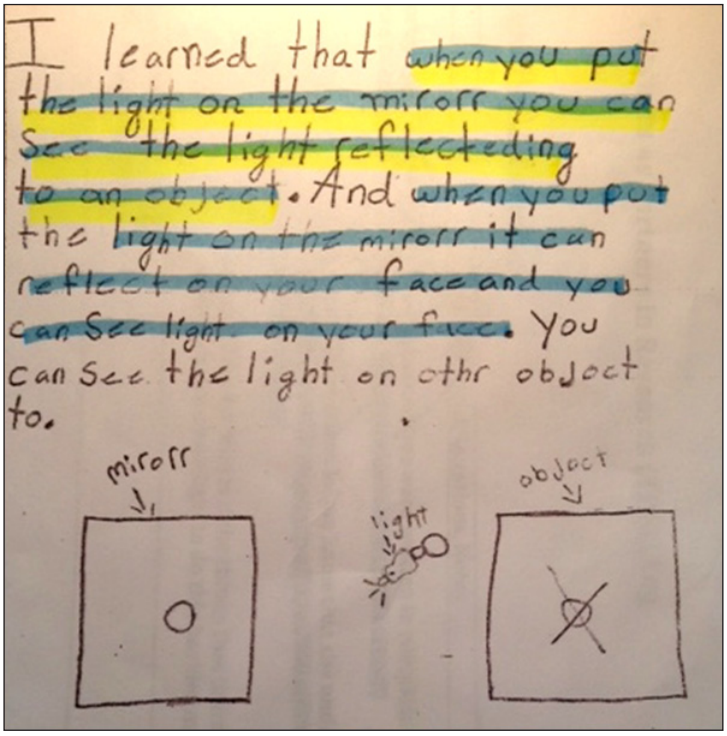
The teacher transcribed some of the things Dawn shared during a Science Talk about shadows:

- ✓ ***Shadows follow you.***
- ✓ ***We think that if you put the eraser on the flashlight it makes the shadow a different color.***
- ✓ ***I wonder if you can make two shadows with one thing.***

Dawn's learning progression had taken a rapid upturn by mid-spring. The Science Talk showed how Dawn was developing an inquiry frame of mind. Her questions and comments reflected careful, autonomous observations. Her thinking showed originality and authenticity, and she volunteered information in front of the larger group. Her teacher attributed Dawn's rise in participation to the deliberate partnering with a student who was outgoing but respectful of other people's ideas, and who didn't dominate the conversation.

The final prompt in Dawn's journal entry asked her to ***tell what you know about reflected light. Use words and pictures—at least one paragraph***. Ms. Masters observed Dawn working during the assignment.

> ***Dawn struggled to write the paragraph. She needed extra time and many reminders to complete the assignment.***



Although producing a paragraph was still arduous for Dawn at the end of her school year, her accompanying drawing revealed intellectual progress. Her drawing focused more precisely on what she was conveying in her writing. It was labeled, and the objects she drew were placed correctly to illustrate the dynamic she described in her writing. The writing and the drawing were both accurate expressions of ideas she had figured out for herself and was able to describe to others.

The final assignment also showed that Dawn had become a better scientist. She used science process skills: observing, documenting what she had seen, analyzing ideas and information, and communicating with others about what she was learning. She also learned some very basic science concepts, e.g., that a mirror reflects light. Dawn's science journal entry showed how her overall writing competency had improved. Her writing was more fluent and more grammatically correct. Overall, during the course of the school year Dawn progressed in many of the learning dimensions that concerned her teacher months before during the Snails unit.

Ms. Masters wrote in her teacher log the following analyses of Dawn's final writing assignment:

- ✓ ***Dawn's observations were written in complete statements.***
- ✓ ***The science content concept is correct.***
- ✓ ***Dawn's observations (including her drawings) let me know that she understands that light can travel by reflecting off a mirror and will shine onto another object.***

On the following page is Ms. Masters' final teacher log entry for Dawn, written at the end of May as Dawn finished up the third grade. Highlighted are phrases that point to the learning progressions Dawn realized through the Integrating ELD and Science program, benefits that often go unnoticed and unheralded in traditional assessments of student achievement.

Teacher Observations	Teacher Interpretations, Questions, Notes
*Dawn has made a **significant amount of progress this year.***	*Dawn has changed throughout this year. She began the year as a very quiet, very shy student who solely relied on the work of others to participate. This is not the case now at the end of this academic school year.*
*Dawn **speaks more frequently and more confidently than ever before in the class**.*	***Dawn is now a vocal learner**. She frequently raises her hand, shares ideas, asks questions, talks more with her classmates and plays a more active role in much of the learning. In her last experiment, I noted that she did not take initiative in the experiment, spending most of her time just wandering with a flashlight. After thinking more about this and listening to her presentation on the experiment, I now know that **what she was doing was testing other objects in the room to see if they would reflect light. This shows some thought and initiative on her part towards the science concept we were studying.***
*Dawn has **shown new confidence in her abilities and does not as frequently rely on the work or words of others to complete her assignments.***	***Dawn has also grown in her writing.** She has grown **from a student who only wrote a simple statement to one who gives detail and provides evidence for her thinking.** Although the evidence is limited, she still has provided a reason for her thought.*
*Dawn's **writing has grown from very few words/sentences to more of a paragraph style of writing.***	*Grammatically when using language conventions as lenses for looking at her progress, Dawn has grown in these areas as well: She has **shown more confidence in her writing**, not relying on the work of others to get her by. She is **now writing her own thoughts in complete sentences using words that are spelled correctly most of the time**. **Her thoughts are complete as well.***

What does the concept of student progressions reveal about the benefits of the Exploratorium/SVUSD Partners in Innovation: Integrating ELD and Science program that standardized assessments miss?

The story of how Dawn, a third-grader in her elementary school in Sonoma Valley USD, progressed from a shy and almost silent student in the fall to one who in the spring participated eagerly in class and exhibited greatly enhanced language and science skills illustrates the efficacy of the Integrating ELD and Science program. Although it is unlikely that she would have scored strongly on a standardized achievement measure at the end of the year, the ***student progressions*** lens reveals how much learning Dawn actually achieved.

She gained confidence and fluency in oral language. She gained competency in writing. Her writing was no longer a mimeograph of another students' response. She provided details, her own ideas, as well as drawings to illustrate her thinking. At the same time she acquired firsthand experience with important science phenomena such as living things and shadows and light, and in the process learned science content. **All of these competencies are critical building blocks necessary for developing the knowledge and skills that can ultimately show up on traditional assessments, but while "under construction" may be invisible.**

Following on this **Introduction and Rationale** for Student Progressions in Science and Language Development, several companion documents are also available. The documents focus on ***student progressions*** in key learning dimensions: 1) Progress in Developing Positive Attitudes and Confidence, 2) Progress in Learning Science Content, 3) Progress in Developing Science Practices and Thinking Skills, and 4) Progress in Developing Language Fluency and Complexity. Each draws on actual student work and teacher analyses that grew out of the collaboration among Inverness Research and SVUSD teachers. They are available to the reader at www.inverness-research.org.

Partners in Innovation: Integrating ELD and Science
Exploratorium/Sonoma Valley Unified School District

Project Portfolio

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STUDENT PROGRESSIONS IN SCIENCE AND LANGUAGE DEVELOPMENT:
→ **An Introduction and Rationale** ←
Progress in Developing Positive Attitudes and Confidence
Progress in Learning Science Content
Progress in Developing Science Practices and Thinking Skills
Progress in Developing Language Fluency and Complexity

Inverness Research, a national education evaluation and consulting group headquartered in Northern California, has over 25 years of experience studying local, state, and national investments in the improvement of education.

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