Next Generation Science Standards

Lisa Lisle
5th Grade Teacher
Brandon School

GUSD District Curriculum Council
GUSD NGSS Steering Committee
SBCEO NGSS Leadership Consortium

A shift is happening......

2019

A New Vision for Science Education

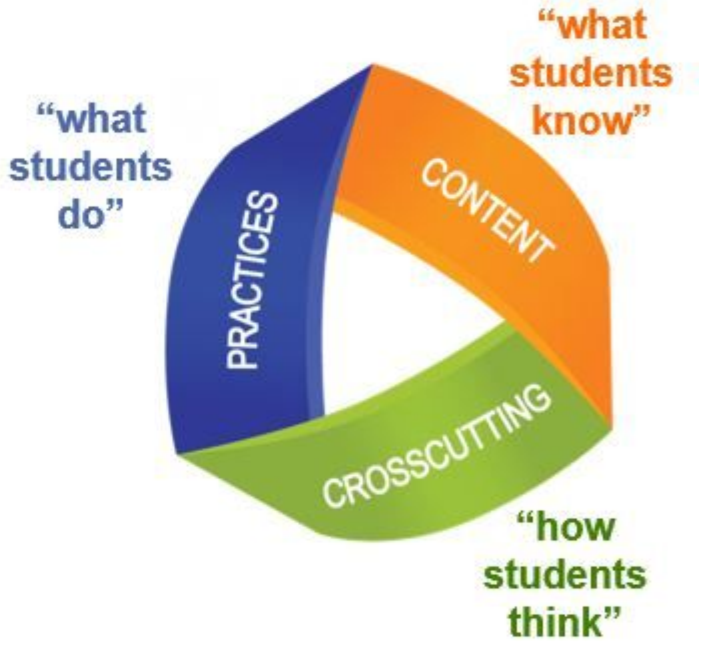
Implications of the Vision of the Framework for K-12
Science Education and the Next Generation Science Standards

SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Student writing of journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

Source: National Research Council. (2015). *Guide to Implementing the Next Generation Science Standards* (pp. 8-9). Washington, DC: National Academies Press. http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards

The 3 Strands of the NGSS
(3-Dimensional Learning)

1. Science and Engineering Practices (SEP)
2. Crosscutting Concepts (CC)
3. Disciplinary Core Ideas (DCI)



Quoted text from Peter A'Hearn

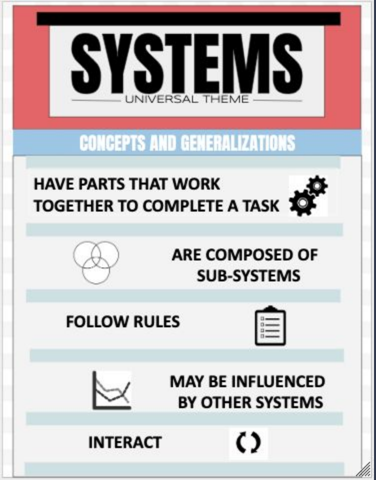
Science and Engineering Practices

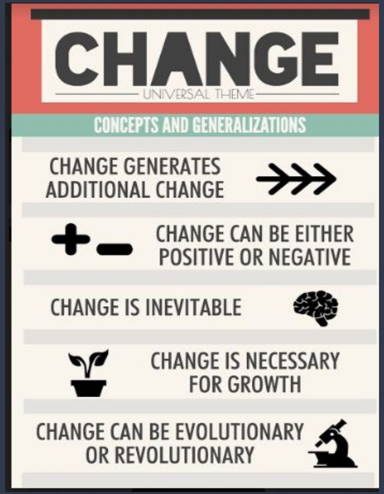
(Mathematical Standards of Practice)

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

(Universal Themes)





1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

1. Depth not Breadth
2. Provide a key tool for understanding or investigating more complex ideas and solving problems.
3. Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technical knowledge.
4. Be teachable and learnable over multiple grades. Progressions are K-2, 3-5, 6-8,9-12

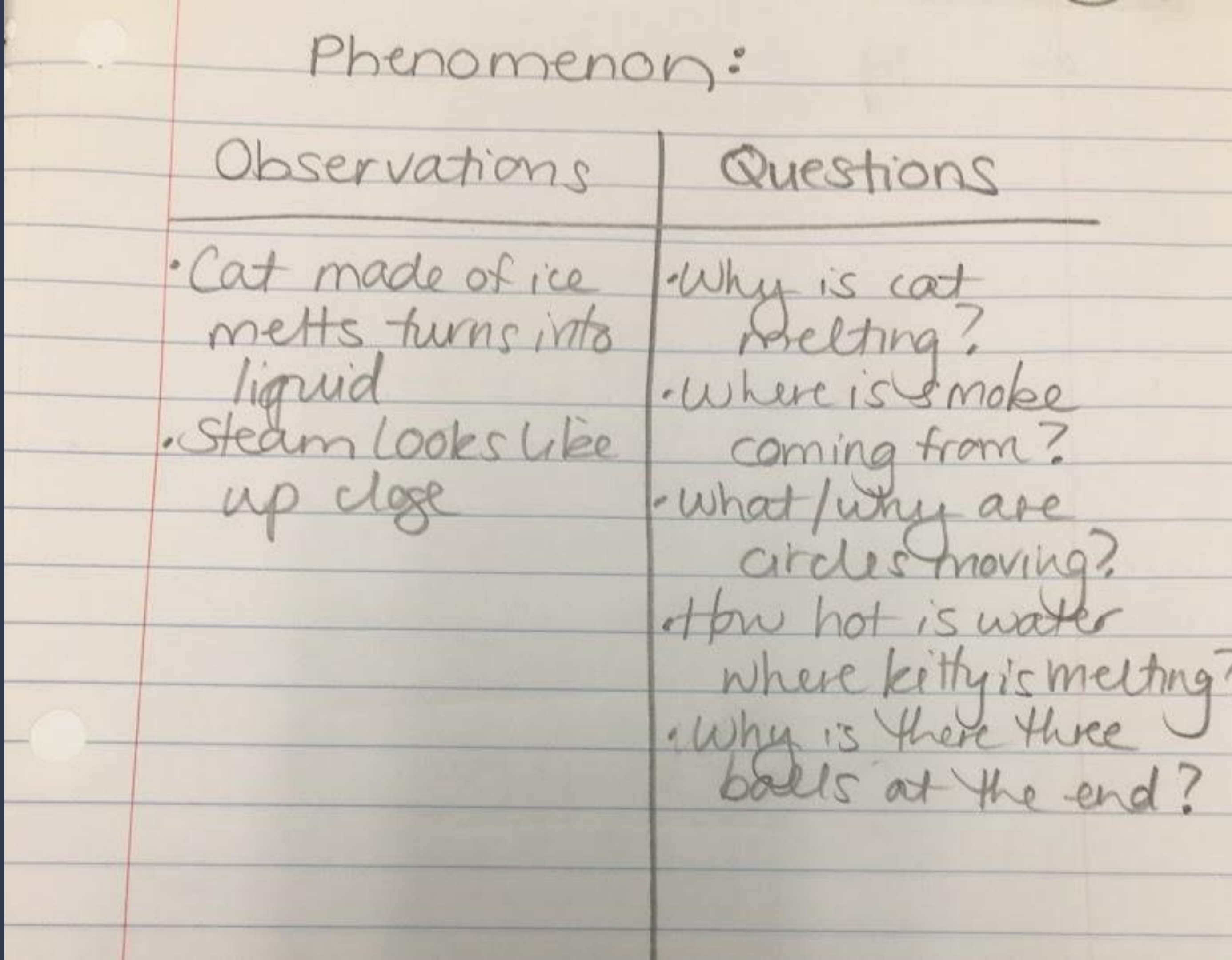
What does this look like in a classroom?

ENGAGE

Start with a PHENOMENON

- observable events in nature (or our lives) that connect to multiple **NGSS** disciplinary core ideas
- Throughout a unit, students work towards explaining the science concepts behind the **phenomenon** in their own.
- Does not have to be a video. Often hands-on.

Record Observations and Questions

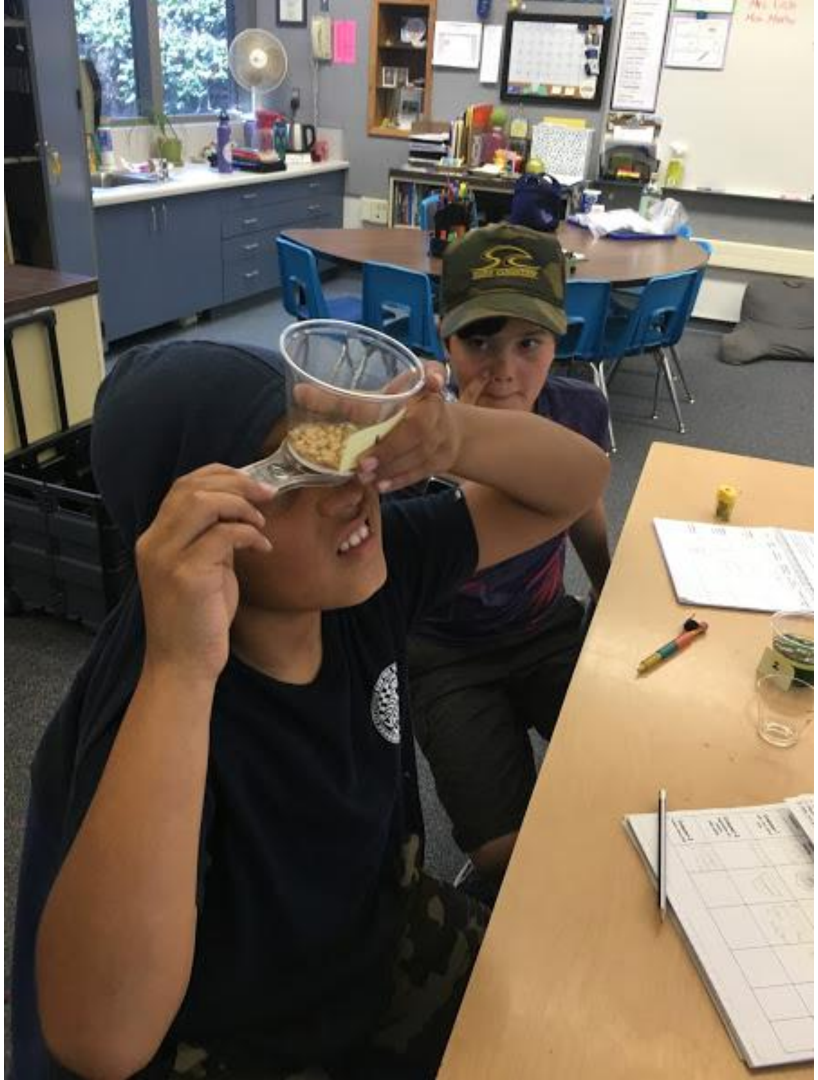


Phenomenon

Observations	Questions
-It is Yellow	-What are the different cemicals in the lava lamp?
-there are circles	-Is that liqpid water?
-there are different sizes	-How much heat does it need?.
-they move slow	-How many different shapes can it make becides circles?.

Explore

- Have a common, concrete, meaningful experience.
- Conduct activities, predict, form hypotheses
- Record observations
- Try many alternatives to solve a problem and discuss them with others
- Share ideas




2

22

$$\begin{array}{r} 800 \\ +247 \\ \hline 5{:}53 \end{array}$$

2 47

4m 45

$$\begin{array}{r} 800 \\ -450 \\ \hline 3{:}50 \end{array}$$

Variable: Amount

$$\begin{array}{r} 800 \\ -445 \\ \hline 3{:}55 \\ +355 \\ \hline 7{:}10 \end{array}$$

Observations:

- The fuller cup disinigrated faster at 3:55
- The less full cup finished last with a time of 5:53
- The less full water is more purple than the full cup

We stired one with hot water to the top, so it desolved faster

Life Saver

Observations

Tempature

- The hot water dissolved dissolved faster than the cold

Size

- The smaller pices dissolved faster

Amount of Water

Less water took longer (color was darker)
More water was faster (color was lighter)

Movement

stirring dissolved faster

We Cause & Effect Sentence
Stirred rappidly so, the life saver dissolved faster.


THINK

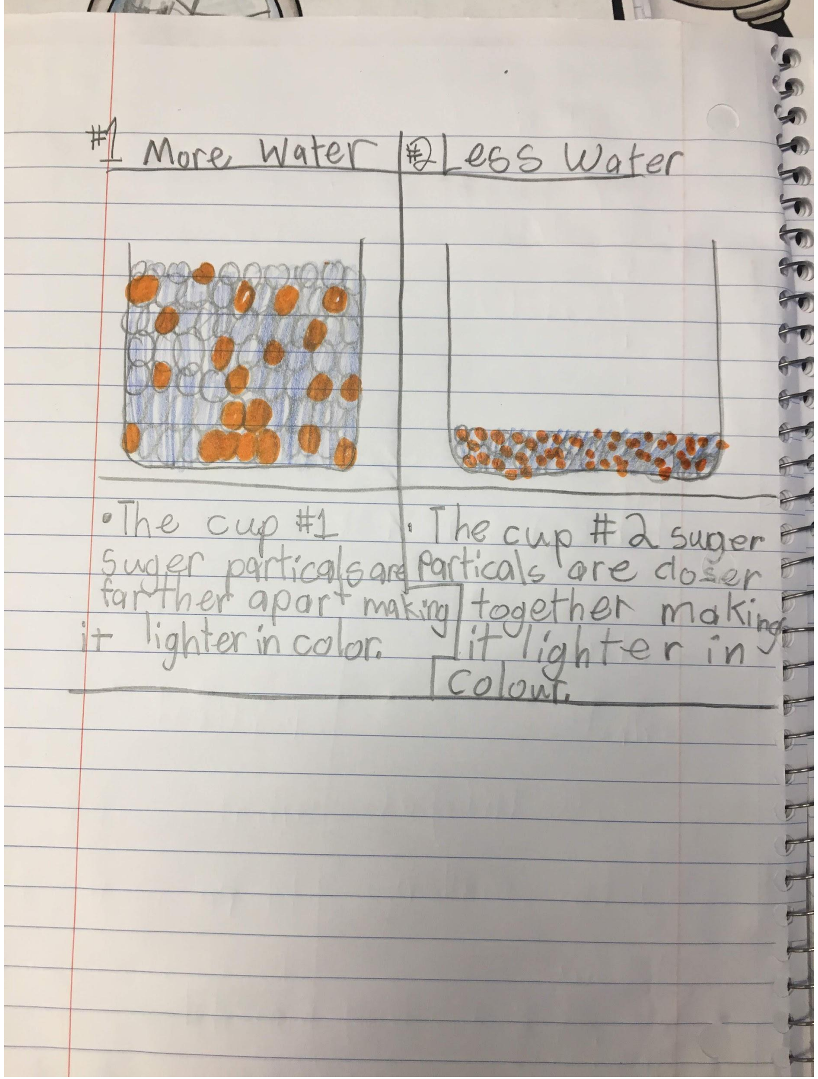

CARR


SCIENCE
NOTEBOOK

Explain

Students have an opportunity to:

- Use the "Language of the Discipline"
- Explain possible solutions
- Listen critically to others' explanations
- Question others' explanations
- Use recorded observations



October 8th 2018

looked over october 9th 2018

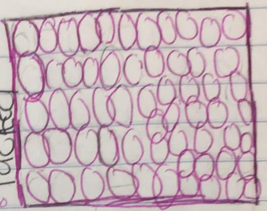
States of Matter

Partiles Model

O = Particles

Solid = It has its own shape, with volume and mass, the Particles sit and move together, but they don't bang into eachother.

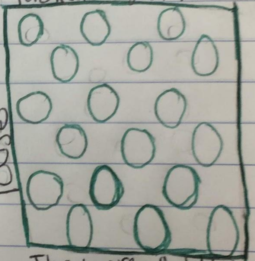
Packed



They are very packed together

Liquid = Does not have its own shape, takes the shape of container, the particles almost move together insync

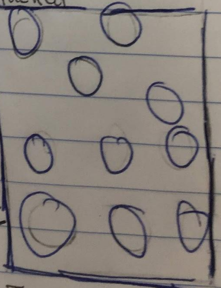
loose



They are a little packed

Gas = Does not have its own shape or sepecific Volume, None of the particles would not hit eachother.

Free

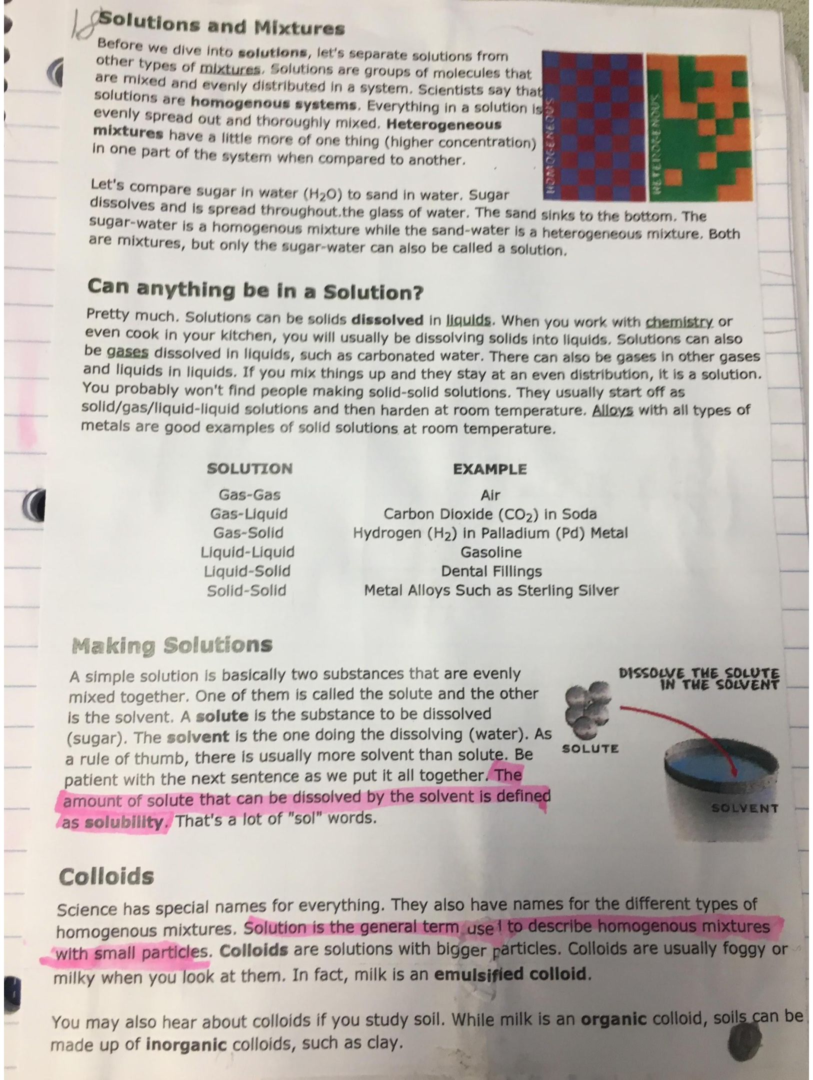


They move

Elaborate

Students have the opportunity to:

- Apply explanations in new, but similar situations
- Use previous information to ask questions, propose solutions and design experiments
- (This often looks like engineering)



Solutions and Mixtures

Before we dive into **solutions**, let's separate solutions from other types of mixtures. Solutions are groups of molecules that are mixed and evenly distributed in a system. Scientists say that solutions are **homogenous systems**. Everything in a solution is evenly spread out and thoroughly mixed. **Heterogeneous mixtures** have a little more of one thing (higher concentration) in one part of the system when compared to another.

Let's compare sugar in water (H_2O) to sand in water. Sugar dissolves and is spread throughout the glass of water. The sand sinks to the bottom. The sugar-water is a homogenous mixture while the sand-water is a heterogeneous mixture. Both are mixtures, but only the sugar-water can also be called a solution.

Can anything be in a Solution?

Pretty much. Solutions can be solids **dissolved** in liquids. When you work with chemistry or even cook in your kitchen, you will usually be dissolving solids into liquids. Solutions can also be gases dissolved in liquids, such as carbonated water. There can also be gases in other gases and liquids in liquids. If you mix things up and they stay at an even distribution, it is a solution. You probably won't find people making solid-solid solutions. They usually start off as solid/gas/liquid-liquid solutions and then harden at room temperature. Alloys with all types of metals are good examples of solid solutions at room temperature.

SOLUTION	EXAMPLE
Gas-Gas	Air
Gas-Liquid	Carbon Dioxide (CO_2) in Soda
Gas-Solid	Hydrogen (H_2) in Palladium (Pd) Metal
Liquid-Liquid	Gasoline
Liquid-Solid	Dental Fillings
Solid-Solid	Metal Alloys Such as Sterling Silver

Making Solutions

A simple solution is basically two substances that are evenly mixed together. One of them is called the solute and the other is the solvent. A **solute** is the substance to be dissolved (sugar). The **solvent** is the one doing the dissolving (water). As a rule of thumb, there is usually more solvent than solute. Be patient with the next sentence as we put it all together. The amount of solute that can be dissolved by the solvent is defined as **solubility**. That's a lot of "sol" words.

Colloids

Science has special names for everything. They also have names for the different types of homogenous mixtures. Solution is the general term used to describe homogenous mixtures with small particles. **Colloids** are solutions with bigger particles. Colloids are usually foggy or milky when you look at them. In fact, milk is an **emulsified colloid**.

You may also hear about colloids if you study soil. While milk is an **organic** colloid, soils can be made up of **inorganic** colloids, such as clay.

Evaluate

Students have the opportunity to:

- Provide reasonable responses and explanations to events or phenomena
- Demonstrate understanding or knowledge of concepts and skills
- Answer open ended questions by using observations, evidence, and previously accepted explanations

Steps for implementing NGSS in GUSD

- DCC and NGSS Steering Committee spearheading the implementation.
- Phenomenon training for teachers in Spring 2018
- NGSS 101 PD for teachers in November 2018
- Conceptual Shifts and SEP's training in January 2019

Piloting for Adoption

- Pilot January through May of this year
- Adopt for Fall 2019
- Two programs