Leadership in STEM Final Project

I. The title of my project is **NGSS Integration- Full STEAM ahead!** The school I work for is a private school in the Bay Area of California and we are looking to improve our science curriculum, with special focus on early childhood and elementary science.

II. The **curriculum topic** for this project was science. Specifically, under NGSS standards for California, the topics addressed were interdependent relationships in ecosystems: animals, plants, and their environment; and weather and climate. The **school** that I presented this professional development for my peers was at Stratford School in Santa Clara, California. Our school serves students from preschool through fifth grade with about 900 students total. The preschool through transitional kindergarten grade levels serve about 300 of the total number of students. The **number of educators** that I presented to was 15 in total, including my direct supervisor. The **grade level** that these teachers teach ranges from preschool through transitional kindergarten. These teachers are my peers on my team and teach students between the ages of 2.5 to 5 years old. These teachers are the main classroom teachers, and they work in pairs team-teaching.

III. The NGSS standards for California Public Schools addressed are:

* K-LS-1 Use observations to describe patterns of what plants and animals need to survive.

* K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals and the places they live.

* K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.

(See Appendix for other standards addressed including California Common Core standards, Science and Engineering Practices, and Disciplinary Core Ideas.)

IV. **Summary of Project:** The school I work at is developing curriculum that is strongly aligned with NGSS and aims to integrate STEM more efficiently. I recently asked my peers about their comfort level with NGSS and technology; out of a team of twenty-eight teachers, only one of them was comfortable with the idea of being able to implement STEM effectively. The goal of my professional development was to introduce the NGSS standards clearly, and to show them how using the 5E lesson plan efficiently could enhance their STEM integration seamlessly.

V. **Pre-Survey Questions:** Teachers were asked to submit feedback regarding the NGSS and the 5E style of lesson planning.

a) How much do you know about NGSS? Choices of answers were: familiar, heard of them, or unfamiliar.

b) What is your level of comfort with the technology we use here in the classroom (Dash and Dot and Beebot robots)? Choices of answers were: excellent, very good, or satisfactory.

c) What is your cross-curricular integration comfort level for Science, Technology, Engineering, Math, and Art? Choices of answers were: excellent, very good, satisfactory, or fair.

d) How much do you know about the 5E style of lesson planning? Choices of answers were: familiar, heard of before, or unfamiliar. Optional questions were as follows;

e) What would you like to know about NGSS?

f) What would you like to know about the 5E lesson plan?

g) What barriers do you face or see facing with STEM integration?

VI. Brief description of the actual professional development training

I began my professional development by talking about how even our youngest of students will need an education that provides them with 21st century skills, and a curriculum that emphasizes STEM can develop these skills for children of all ages and abilities. I discussed the team's familiarity with the Next Generation Science Standards; I briefly mentioned how these standards were recently developed, and how states were starting the beginning stages of implementation. I then presented my slideshow on the NGSS; What are these standards; The three components of the standards: science and engineering practices, disciplinary core ideas, and cross cutting concepts; and detailed information about each component. We briefly discussed an example of a standard and how the three components related to the standard. I then presented my slideshow on the 5E lesson plan instructional model; What are the 5E stages; what each stage represents (https://nasaeclips.arc.nasa.gov/te); and a 5E lesson plan that I developed for use in the classroom. At the end, I reserved time for any questions the team had about anything related to the presentation.

VII. Brief outline of the activities in the unit

a) A short trip/field trip to the local garden; explore and discuss.

b) Read *Planting a Rainbow* by Lois Ehlert; teacher will bring in local plants for students to observe and record data by writing/drawing.

c) Read *Growing a Vegetable Soup* by Lois Ehlert; students will document in their notebooks with photographic evidence and drawings of native plants.

d) Planting seeds; students will document data over short extended periods of time, and teacher will introduce vocabulary and discuss with students.

e) Assessments; students will label notebooks with appropriate photos and weather documentation.

VIII. What NASA data did you include?

a) NASA eClips 5E instructional model description: https://nasaeclips.arc.nasa.gov/teachertoolbox/the5e

b) NASA 5E instructional model PDF: https://www.nasa.gov/sites/default/files/atoms/files/the_5e_instructional_model.pdf

c) NASA 5E model visual: https://sites.google.com/site/nasajplcsunpsti/activities/stem-lesson-design/5e-model

IX. Follow-up activities and Post-Questions Survey List

The amazing thing about my professional development was it motivated me to approach my direct supervisor about holding a STEAM night at our school. I was excited when she approved! I was asked to help plan and organize the logistics, and every member of the team (11 classrooms and 22 teachers) was required to come up with a theme and an age-appropriate activity in the areas of science, technology,

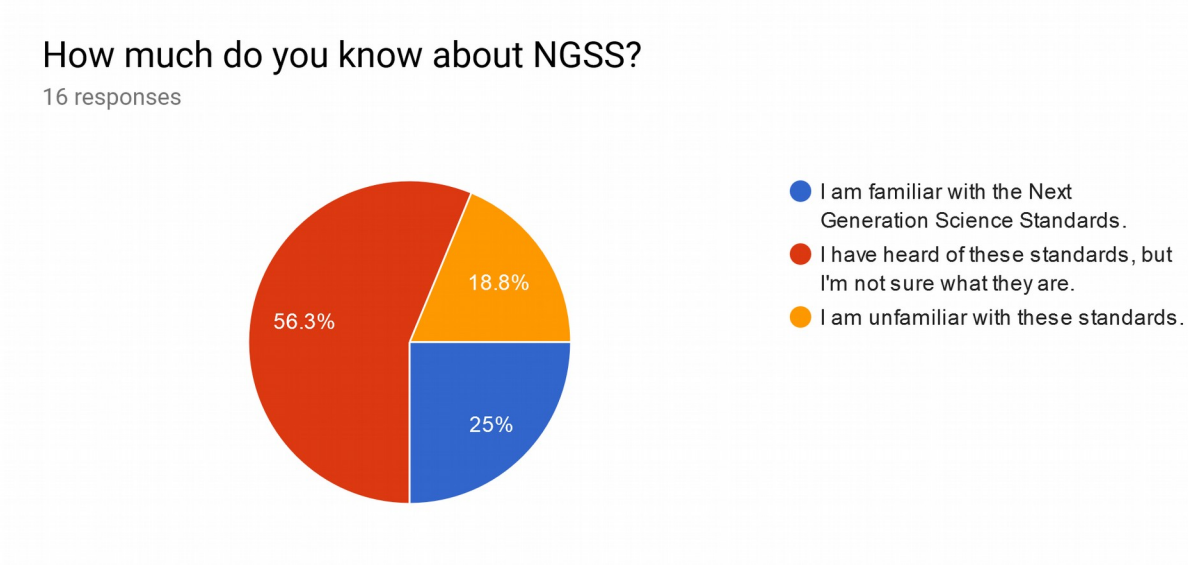
engineering, art, or math. Each activity would use recyclable or new materials that we already have and would also have to be hands-on with a time limit of ten minutes maximum. The activities would be set up in stations in the auditorium; students would be grouped by age and have 30 minutes to cycle through stations on their own with the assistance of either their teachers and/or parents. We are holding this STEAM night next month, and I am very excited to hold this event and expand upon it in the future. I also gave a short presentation on our NASA Endeavor program to my team of science teachers.

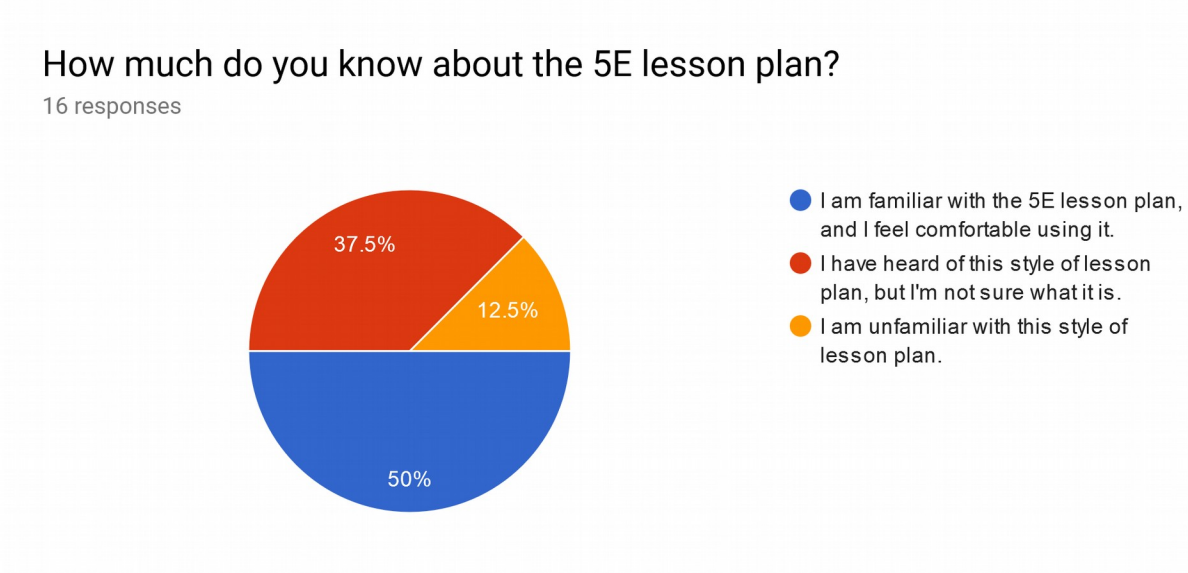
Post-survey questions: Teachers were asked to submit feedback regarding my presentation.

a) How much do you now know about NGSS? Choices of answers were: I have a better understanding, I now know more, or I would like more information.
b) Which of the three dimensions do you have a good understanding of? Choices of answers were: Science and Engineering practices, Disciplinary Core Ideas, Cross-Cutting Concepts, or all of them.
c) Would you prefer follow-up sessions for more information? Choices of answers were: yes or no.
d) Would you like ideas on how to integrate STEM or on how to design lesson plans using NGSS? Answer option was open-ended.
e) Optional questions included what follow-up questions do you have? And do you have any other questions?

X. Outcomes: Final data collection and analysis

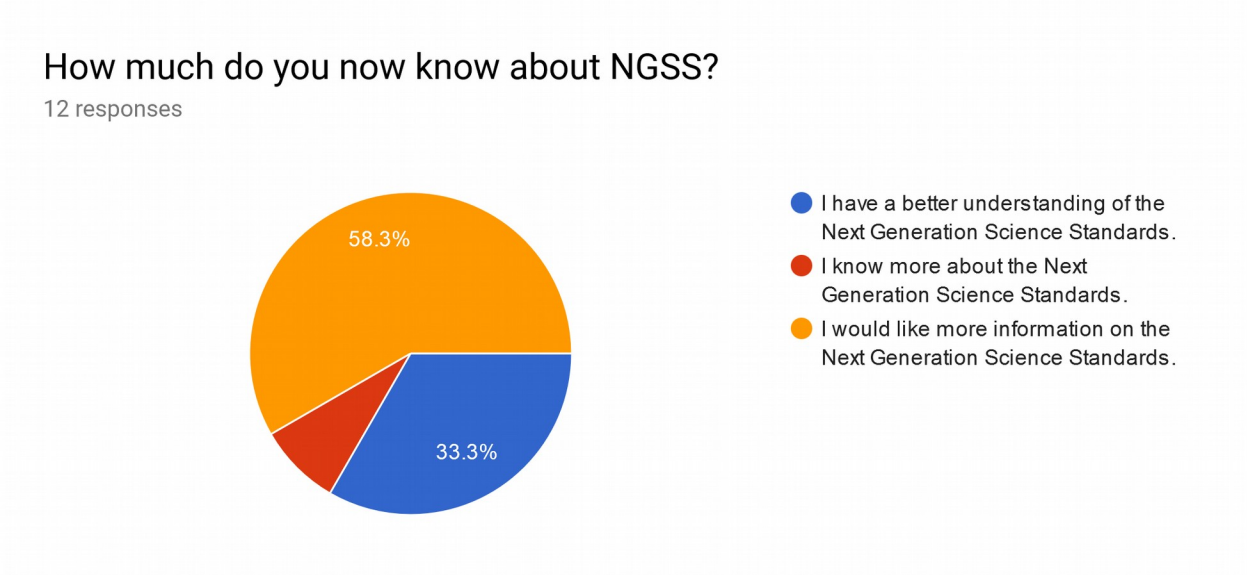
a) PD pre-survey results and comments; (https://docs.google.com/spreadsheets/d/1tDMXkBNHBUzYCFED49F8aC9Tcmd-JfwCfoU6k-lm_Wg/edit?usp=sharing)

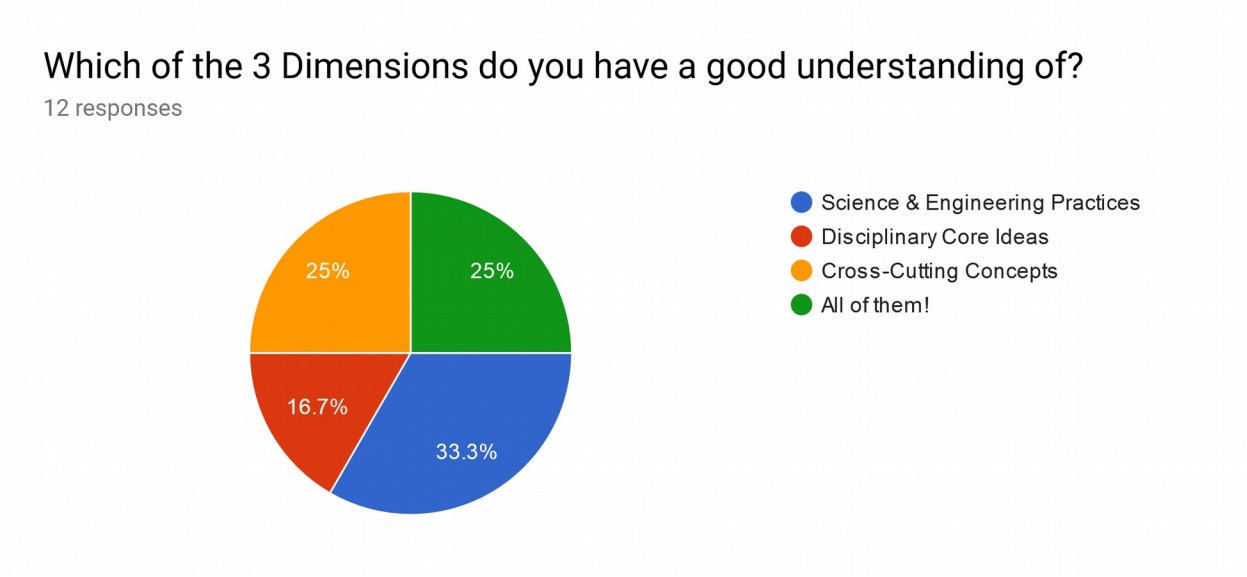




Out of 28 team members, 16 members offered to participate in the project surveys to give feedback. A little over half of the team members responding had heard of the NGSS standards but were not too sure what they were. Half of the team members responding felt comfortable with knowing about and using the 5E lesson plan. Many teachers replied that they would like to know how to apply the standards into their lessons, and how to use the standards to implement aligned activities in the classroom. About 60% of the respondents felt very good with using robots and technology in the classroom. Most respondents felt "very good" about cross-curricular integration in all areas. Many respondents wanted examples of 5E lesson plans, and a few teachers wanted to learn how design the lesson plan themselves. As for the final question regarding barriers facing the team with STEM integration, the three most common replies were time, materials, and training.

b) PD post-survey results and comments;
(https://docs.google.com/spreadsheets/d/1DieiwwsQ5irddHATyaFKJ_Ys9WRPxlAt8wjONW3fSS4/edit?usp=sharing**)**





Out of 16 prior respondents to the pre-survey, only 12 of the team members responded to the post-survey. Although more respondents said they have a better understanding of the NGSS standards than prior, 58.3% stated they would like more information on them. 33.3% of respondents stated that they now have a good understanding of the Science and Engineering practices, with 25% of them stating they now have a good understanding of all of the three dimensions. 9 out of 12 respondents would prefer follow-up sessions; all respondents would like ideas on how to implement STEM and how to design lesson plans aligned with the NGSS. Most respondents did not have any further questions.

c) I believe my professional development was somewhat successful. Being able to present this information to my team members was an accomplishment in itself. Out of the 16 participants, only 12 responded to the post-survey. My team consists of 22 teachers, and it would have been better if all members participated in this project. Also, I would have like to follow-up my presentation with another session so teachers would have a better understanding of the NGSS. I was not allowed to have any follow-up; however, I did present about the Endeavor program to my team of science teachers (16) and they were all very interested to learn more. Overall, I feel this project was a good start but could be improved upon for the future.

d) This project related to the readings in two ways. Kaniuka (2012) discusses school reform and trying to understand how teachers change during school improvement. “Improvement is more of a function of learning to do the right things in the settings where you work.” (Kaniuka, 2012). Leaders and educators need to know the right small steps to take in order to lead towards long-term change. Kaniuka (2012) also states that “school reform will depend on listening to teachers as they implement reform and experience successes, failures, and difficulties.” It is important that teachers’ feedback and voices are heard. DeSimone (2011) discusses effective professional development and what it entails. “Effective professional development includes a content focus, active learning, coherence, duration, and collective participation.” DeSimone, 2011). All of these components are key for developing a successful professional development for teachers. DeSimone (2011) also states that “successful professional development follow these steps: teachers experience the professional development; it increases their knowledge and skills,

attitudes and beliefs or both; teachers then use their new knowledge, skills, attitudes, and or/beliefs to improve the content of their instruction, approach to pedagogy or both; and the instructional changes that the teachers introduces to the classroom boosts their students' learning." Sustainable and successful change comes with teachers changing as well, not just hearing about new knowledge or being fed information with no engagement.

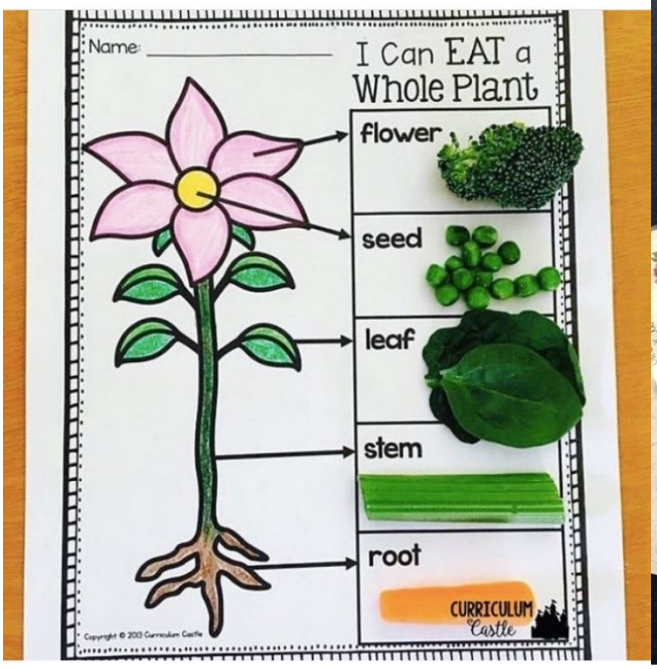
e) Will the teachers do these activities again? Some of them will and intend to learn how to better develop lessons and align them with the standards. Some of them are busy with an overflowing plate and do not have the time or energy to dive deeper into their own learning to improve their craft.

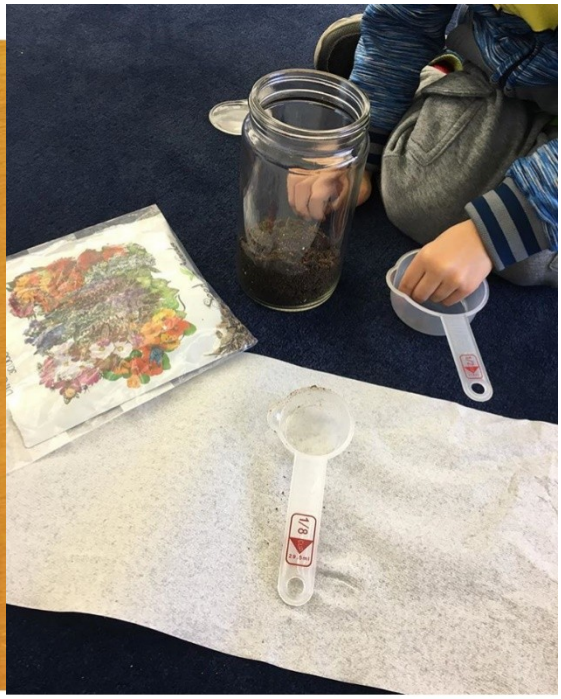
f) Reflection: I think this was a great first start into developing a successful professional development. I think it is key to know your audience well; knowing how much time they have, how much they have on their plate, and how willing they are to learn or know more is critical to having a sustainable and effective PD session. I would need more time over an extended period of time, and I would need the support of leadership and administration to help teachers focus on collaboration and implementation. The feedback I received from the participants was helpful; I do need to focus on their responses of what barriers they face (time, materials, training) and figure out how to support them in these areas.

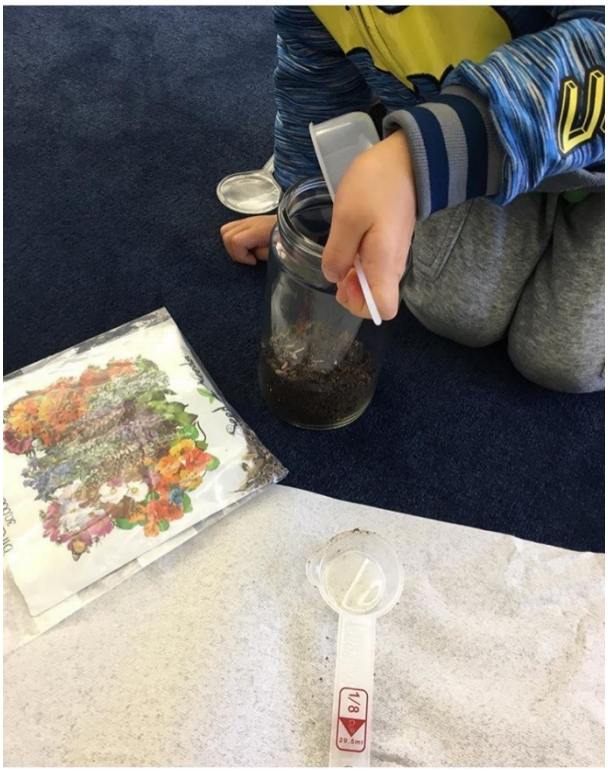
References: DeSimone, L.M. (2011). A Primer on Effective Professional Development. Phi Delta Kappan, 92(6), 68.

Kaniuka, T. (2012). Toward an Understanding of How Teachers Change During School Reform: Considerations for Educational Leadership and School Improvement. *Journal of Educational Change, 13*(3),327-346. doi:10.1007/s10833-012-9184-3.

Appendix XI: Classroom Activities/Unit with Assessment







Pictures above were of students planting and inspecting native seeds from our area. They also completed a worksheet of different parts of the plant that they can eat. This demonstrates activities from the 5E lesson plan given to teachers during my presentation. (See 5E below).

XII. Contact information of four educators who attended the PD: a) Anju Bhagavan- abhagavan@stratfordschools.com b) Dalhi Sanko- dsanko@stratfordschools.com c) Lea Johansen- ljohansen@stratfordschools.com d) Serene Wheelwright- swheelwright@stratfordschools.com

Teacher: Adriana Salazar

Date: March 2018

Subject: STEM

Materials:

Seeds

Potting soil

Planting containers

Notebook

Data record sheets

Measuring cups

Digital camera

Mini shovels

Rulers

Measuring tape

Book**:** *Planting a Rainbow,* by Lois Ehlert.

Book: *Growing Vegetable Soup*, by Lois Ehlert.

Book: *California Plants in Their Homes: A Botanical Reader for Children*, by Alice Merritt Davidson.

NGSS for California Public Schools

K-LS1-1. Use observations to describe patterns of what plants and animals need to survive.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals and the places they live.

K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.

California Common Core State Standards Connections

ELA/Literacy: W.K.7 Participate in shared research & writing projects (explore books by authors & express opinions about them).

Math: K.CC.6-7 Compare numbers.

K.MD.1 Describe measurable attributes of objects, such as length or weight.

K.MD.2 Directly compare two objects with a measurable attribute in common, to see which object has “more or less” of the attribute and describe the difference.

Lesson Objectives: Students will learn:

1. To define what plants need to grow & thrive.
2. To tell about the local weather during the spring season.
3. To give examples of which plants grow in California.

ENGAGEMENT (Anticipatory set; Half day class field trip)

- Students visit the local or school garden. (Example: Field trip to San Francisco Botanical Garden, located in Golden Gate Park.)
- Students work in small groups to explore the plants in the garden.
- Students record observations through writing and photographs.
- Which plants did you see?
- Which plants were growing well? How do you know?
- What was the weather like for that day? Temperature? Sunny or cloudy?

EXPLORATION (Direct instruction; 30 mins)

- The teacher reads the book, *Planting a Rainbow* by Lois Ehlert. The teacher will bring in local plants for students to investigate. The teacher guides the students briefly through a booklet of native plants from California.

- As a class, in small groups, the students will observe and record data about the plants. Students observe, discuss and illustrate pictures about plants in their notebook. Teacher will rotate to different groups asking them questions to help them write/draw observations. (What do you see? What does the plant look like? What color is it? How big is it? Etc.)

  The big idea: Earth is a unique planet that allows living things to grow because it has oxygen, sunlight, and water.

EXPLANATION (Guided practice; 40 mins)

- The teacher will read the book, *Growing a Vegetable Soup*, by Lois Ehlert.
- Students verbally identify what plants need to grow and thrive.
- Students will give examples of plants that grow in California.
- Students will review photographic evidence and illustrate pictures of native California plants in their notebooks.
- Students will answer questions from teacher in their notebooks. (Which plants are native to California? How do you know? What do they look like?)

ELABORATION (Independent practice; 2 day lesson- each class session 45 mins)

- Students will plant their own plants using seeds, soil, mini shovels, and planting containers.
- Students will observe and record weather data, and plant growth through documentation, photographs, and illustrations.
- Students will observe and record briefly over the course of several days.
- Students will be introduced to vocabulary, and the teacher will engage students in a discussion about how it connects to their observations. (What do plants need to grow? How did the plants grow best? Which plants grew, and which did not? How do you know? What do you notice about the weather pattern for those days? Review plant vocabulary. Have students think about what questions they may have after this lesson for further elaboration.)

EVALUATION (Closure & assessment)

- Students will distinguish between different native California plants. (Place correct plant label on paper with pictures of plants.)
- Students will be able to successfully recognize types of plants. (Teacher evaluates notebook drawings; Teacher will then ask to students to match photographic evidence to illustrations drawn in their notebooks.)
- Students will be able to cite data evidence as to which weather helps these plants grow best. (Teacher evaluates notebook additions; Teacher will then ask students to add sunny, cloudy, and/or rainy icons to each plant page. Students will turn in notebooks with added weather pictures.)

Justification:

***Science & Engineering practices demonstrated in this lesson*:** Planning and carrying out investigations; making observations to collect data that can be used to make comparisons. (K-PS3-1.)

Use a model to represent relationships in the natural world. (K-ESS3-1.)

Connections to Nature of Science: Scientific investigations use a variety of methods; scientists use different ways to study the world. (K-PS3-1.)

Scientific knowledge is based on empirical evidence; scientists look for patterns and order when making observations about the world. (K-LS1-1.)

Disciplinary Core Ideas: Energy flow in organisms; all animals need food in order to live and grow. They obtain their food from plants or other animals. Plants need water and light to live and grow. (K-LS1-1.)

Natural Resources; Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1.)

Crosscutting concepts: Patterns; Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1.)

Cause and Effect; Events have causes that generate observable patterns. (K-PS3.1)