

# Infusing Project GLAD® with Inquiry-Based Learning

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In the spring of 2020, Explora Science Center and Children’s Museum in Albuquerque developed and implemented space-themed, inquiry-based science lessons in dual language and English learner classrooms in Albuquerque and Rio Rancho. Developed by OCDE Project GLAD® certified teachers, these Explorations incorporated resources from NASA’s Universe of Learning with three Project GLAD® strategies. The Explorations are available for free at <https://www.universe-of-learning.org/informal-learning/inspiration-discovery-explora-science-center-childrens-museum>. They were implemented in prekindergarten, kindergarten, and fourth-grade classrooms. This article describes why inquiry-based science and Project GLAD® are a natural fit, and how the curriculum successfully incorporated three Project GLAD® strategies: ELD Review, Cognitive Content Dictionary, and Chants.

## Project GLAD® and Inquiry-Based Science

Inquiry-based science and Project GLAD® support one another. A recent meta-analysis found that inquiry-based science instruction increased science academic achievement for English Learners when compared with direct instruction (Estrella et al., 2018). Inquiry activities allow access to higher level critical thinking skills and provide motivation for authentic oral and written communication. However, the paper concluded that inquiry-based science itself may not be sufficient to meet the heavy language demands placed on the English learner. Teachers must also have the understanding and instructional practices to support English learners’ needs. Therefore, a Project GLAD® unit which incorporates evidence-based language

development strategies and inquiry-based science may provide the greatest chance of linguistic and science academic success for English learners.

## Overview of Explora - NASA’s Universe of Learning Lessons

The curriculum contains three Explorations. Each Exploration includes an hour of hands-on activities exploring a particular vocabulary word. “Floaters and Sinkers” looks at **density**, “Massively Fun” focuses on **mass**, and “In a Spin” looks at **rotation**. A NASA Universe of Learning Resources printable poster and video accompany each vocabulary word to provide anchor

visuals, real-world examples related to space, and background information for teachers and students. All materials required for the hands-on activities are inexpensive and easily found at a local grocery or hardware store. “Floaters and Sinkers,” for example, challenges students to make a small clay-ball float using straws, compare the densities of various fruits and vegetables to water, and make a small submarine using a film canister and an Alka-Seltzer® tablet. “Massively Fun” demonstrates how to make an inexpensive, easy balance beam with a ruler and a spring scale with a rubber band so that students can compare the masses of classroom objects. Finally, “In a Spin” uses paper plates and markers to make drawing spin tops, and a cellphone light to explore the rotation of planets.

## Strategies

Effective teachers ask the “right question at the right time.” In inquiry, teachers ask exploratory and meaning-making questions to guide student discovery.

—continued on page 7—



Hands-on inquiry experiences are at the heart of Explora’s science lessons.



—continued from page 6—

### Exploration Questions

For those students who seem to be really interested in the topic of study, exploration questions can help focus attention and encourage active play, experimentation, discovery, and thoughtfulness.

- Tell me what happened?
- What did you notice?
- What does it look like?
- What is it made of?
- What would happen if....?
- What difference did you notice?
- What might you try instead?
- What can you tell me about your experiment?
- How did you do that?
- What does this make you think of?
- In what ways are these the same?
- In what ways are these different?
- What materials did you use?
- What can you do instead?
- What do you feel, see, hear, taste, and/or smell?
- What are some different things you could try?

### Making-Meaning Questions

For some students, making-meaning questions can help solidify their experience into a true learning event. These questions help support reflection, learning, and understanding.

- Why do you think that happened?
- What evidence makes you think that?
- What would happen if we changed . . . ?
- What do you think this tells us about . . . ?
- Do you have any idea how we could test this out?
- What would you need to find out more?

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The Explorations combine three Project GLAD® strategies with inquiry-based science: the ELD Review, the Cognitive Content Dictionary, and Chants.

### The ELD Review

The educator facilitating the Explorations modified

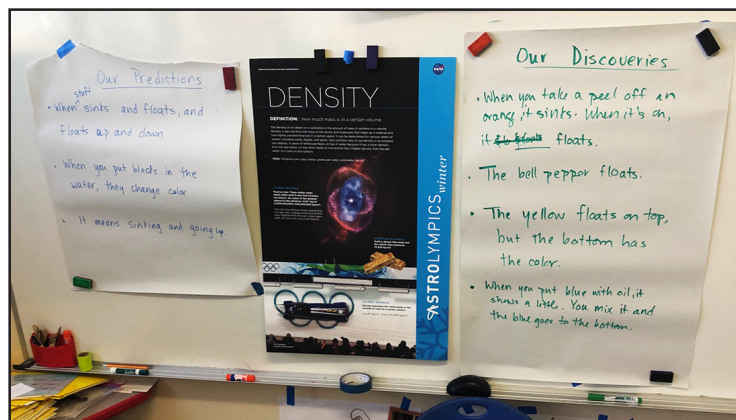
these inquiry science questions to Project GLAD®'s ELD Review strategy. The ELD review strategy has leveled question structures that meet the English learners' proficiency levels as measured by language proficiency assessments. Students at proficiency level 1 are asked "point to/locate/show/find" type questions. These questions require receptive understanding but no productive language. Level 2 students answer "yes/no" questions with a simple one-word response. Level 3 students answer "either/or" questions, which require that the students repeat one of the options given, and students at Levels 4 and 5 are asked open-ended questions, which allow them to use their expanded language skills to answer in longer phrases and sentences. During the Explorations, for example, the educator asked the Level 1 student to, "Show me what you think would happen if you go faster" while the Level 2 student was asked, "Do all things rotate the same way?" Level 3 students were asked, "Will it go faster or slower?" while Levels 4 and 5 students were asked, "Explain how rotation happens on Earth."

### Cognitive Content Dictionary (CCD)

The Explorations used a modified Cognitive Content Dictionary (CCD) to support the explicit vocabulary in the lesson. The CCD is a Focus and Motivation Project GLAD Strategy which promotes Tier 2 and Tier 3 vocabulary acquisition and can be a powerful classroom management tool when the vocabulary word is used as a signal word ("When you hear the signal word, stand up, push

in your chair and line up for lunch"). The strategy evolves over two days and involves introducing a key Tier 2 or 3 vocabulary word related to the unit of study on Day 1. The students, in teams of 3 or 4, are asked to predict its meaning with the teacher scribing exactly what each

team predicts. Over the course of the rest of the



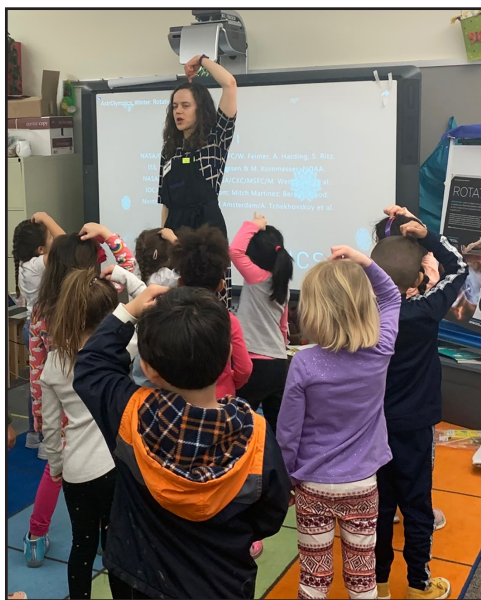
As a modification of the CCD, students were asked to make predictions of the key vocabulary word after a whole-group opening event.

—continued on page 19—

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day, the word is used and explored as a way for students to develop a true definition. On Day 2, the CCD is revisited, the teacher provides a formal definition of the word, and the teams negotiate an oral sentence reflecting their understanding of it. The CCD process was modified for the context of these Explorations. Because inquiry-based science relies on student discovery, the educator introduced the vocabulary word only after students experienced a whole group “opening event” with discussion, one hands-on activity, and a Turn-Pair-Share question to activate prior knowledge. This process ensured that students had both personal and shared knowledge to bring to their predictions of the word.

In the Exploration “Floating and Sinking,” the opening event involved making predictions about which would float or sink in a tub of water—a bowling ball or a ball bearing. The educator placed both in the water and students watched in amazement as the large bowling ball floated and the small bearing sank. Students moved into groups to make predictions about various household objects floating or sinking in water and tested them in a tub of water. The educator then called the students to the carpet and asked them to turn and share with a partner, “What do you know about floating and sinking in water? Have you seen something similar?” After hearing various responses, the educator might say, “We have been looking at things that float or sink in water. When we look at whether materials float and sink in water, we say we are looking at their *density*. Say density to your neighbor, to me, to your elbow. What do you think density means?” The predictions were recorded on the modified CCD. The educator then showed the NASA Universe of Learning poster on “density” and played the video. The subsequent inquiry-based activities all centered around density, and the educator concluded the Exploration by revisiting the modified CCD. The students were asked to turn and share, “What do you now know about density?” and their responses were recorded on the chart.



Children learn chants and accompanying movements that are related to the hands-on activities of the unit.

## Chants and Songs

Finally, the Explorations utilize chants and songs which include target vocabulary words and concepts set to familiar tunes and rhythms. This is a Guided Oral Language Project GLAD® strategy and is effective because it lowers the affective filter for English learners—promoting more risk taking, embeds academic vocabulary in context, and increases acquisition through practice of language patterns. The chants directly relate to the hands-on activities and are recited along with suggested movements which mimic what students experience during the Exploration. In “Floaters and Sinkers,” students use their hands to describe floating and sinking in water as they sing about density. In “Massively Fun,” students tilt like a balance beam as they measure mass, and in “In a Spin,” students rotate around their central axis.

## Future Opportunities

If you’d like to learn more about incorporating inquiry-based science into your Project GLAD units, be sure to look out for DLeNM’s Spring 2022 professional learning opportunity with Explora Science Center and Children’s Museum: “Infusing Project GLAD® with Inquiry-Based Learning.” You’ll learn how to develop high levels of academic language and content knowledge with your language learners while engaging in hands-on science and engineering activities. We will breathe new life into some GLAD® strategy favorites while tapping into the NGSS standards. Participants will receive a kit of materials to use doing the workshop. We hope to see you there!

## References

- Estrella, G., Au, J., Jaeggi, S. M., & Collins, P. (2018). Is inquiry science instruction effective for English language learners? A meta-analytic review. *AERA Open*, 4(2). doi:10.1177/2332858418767402

