An Expanded Observe-Wonder-Learn

Moving Observe-Wonder-Learn From Assessing Prior Knowledge Into a Unit-planning Tool

By Kate Baird and Stephanie Coy

Join us as we describe a model that starts from the basics of the OWL (observe, wonder, learn) large-group discussion strategy then moves onto new experiences that serve as the jumping off point for student-generated questions and investigations. The OWL version of a KWL (Know-Want to Know-Learn) process becomes a path to language learning and inquiry-driven lessons based on the Shared Language model presented by Baird, Coy, and Pocock in *Science and Children* (2015).

WHAT IS OWL AND HOW IS IT USED TRADITIONALLY?

We first discovered the OWL chart at a NSTA conference presentation on *Picture Perfect Science* in 2012. The authors demonstrated how a three-column chart was used as a whole-group anchor chart throughout an inquiry lesson. The O represents what the student has Observed, the W what the student has Wondered, and the L what the student has Learned. This technique is a great process for finding and addressing preconceptions and holes in student learning and language use. Refer to *Picture Perfect Science Lessons: Using Children's Books to Guide Inquiry* (Ansberry and Morgan 2005) for more details on this process, which can take the place of the more traditional KWL strategy as it focuses on the science and engineering practices and the argumentation aspect of *Next Generation Science Standards* (NGSS) three-dimensional learning.

WHAT ARE WE DOING?

Our model is one way to create 3D NGSS units. OWL units are built on the foundation of the science and engineering practices (SEPs) that support the frame of crosscutting concept (CC) driven units of instruction that support all learners. The OWL unit takes the combined 5E and 5R model proposed by Baird, Coy, and Pocock (2015) into a 3D lesson structure supporting traditional as well as developmentally and linguistically challenged learners through a planned language-supported inquiry-process. The OWL takes this model and stretches it into a unit-planning tool that uses disciplinary core ideas (DCI) to support learner-centered, developmentally appropriate inquiries that culminate in authentic writing and media products. The 5E and 5R models were chosen to support language acquisition for all learners. The use of the combined 5E 5R model builds confidence in vocabulary through the development of personal narratives built on experiences within the 5 E lesson. The use of poems, stories, and performances provide for the demonstration of learning within the personal narrative built in these experiences.

DESCRIPTION OF THE OWL UNIT STAGES

Observe has three steps that occur over multiple days and is based on traditional guided-inquiry experiences.

Experience is a teacher-designed exploration or activity. The key idea is that this experience must support data collection and the generation of questions and conclusions. These will be different based on child development, grade band, and crosscutting concepts (CC) and DCIs for the unit. They can be short- or long-term investigations (this will change based on timing within a sequence of units) beginning the 3D NGSS curriculum cycle. Using a backward design planning mindset, the unit planning begins with the performance task to come later. Think of big ideas in weather, space, plants, water, and so on that can open the door to a deeper area of study.

Data is the support for the NGSS science and engineering practices and crosscutting concepts used for this unit. Figure 1 shows the SEPs as they fall into units in this model. The CC will be identified based on the topic and explorations that are being provided by the DCIs chosen for the unit. This

chart is the qualitative or quantitative data collection for the unit. A whole-group discussion or review of what is data and why we use data would be appropriate here. For example, the data might be pictures, websites, measurements, or sketches. This data becomes the support for future Claim Evidence Reasoning (CER), argument, or discourse that will drive the larger inquiry project in the Wonder phase. This task is the first step in building a bridge from the teacher-directed learning toward a student-driven inquiry.

Discourse is the group discussion. The format is open: whole-group, four corners, team reviews, peer editing, and so on. *What are the ideas that come from the data and discussions among the groups? What are the key ideas that are needed to move into the wondering for the next phase? What discourse strategy supports this group of learners at this time? Is this the time for a debate, a project report, or gallery walk?* There are many options.

Wonder may comprise several cycles of observing/wondering in a variety of ways before moving onto the learning stage of the unit. Wonderings enable the crafting and directing of the rest of the unit.

Observation is the phase of asking, now that you have data, what do you still wonder? Why are there still questions? What is next?

Experience will produce the wonderings for the larger unit. No data is required at this time. Movies, videos, guest speakers, animations, simulations, and data sets all can be the source of the wondering experience. These experiences need to be linked to the direction the previous discourse was moving toward. The included lesson plan may help clarify the way these connections might build (Figure 2).

Reveal Research is the design phase of the student-directed research project. (Grade level and student development will determine the amount of free exploration in the next stage.) Science investigation and engineering skills are highlighted in this step. They may be taught for the first time, modelled, reviewed, or just expected. Focus on the depth necessary for this group of learners. Differentiation will be a key component to student success.

Data Analysis is the actual student exploration of the selected wondering/phenomenon data. This is the mathematical thinking and data organization piece of NGSS. Again, differentiation will be a hallmark of a successful unit. Role-playing, modelling, samples, and rubrics are needed to provide structure for early units. Procedure and pro-

FIGURE 1

Overview of an OWL unit.

OWL LEVEL	CLASS ACTIVITY	5E	5R	SEP
OBSERVE	Experience	Engage		Develop and use models
	Data			Use math and computational thinking
	Discourse		Reveal	Engage in argumentation from evidence
WONDER	Observation	Explore		Ask questions and define problems
	Experience	Explore	Replace	Engage in argumentation from evidence
	Reveal Research	Explain	Reposition	Plan and carry out investigations
	Exploration & Data analysis	Elaborate		Analyses data
	Formative assessments	Evaluate	Repeat	Obtain, evaluate, and communicate
LEARN	Shared wondering		Reload	Obtain, evaluate, and communicate Engage in argumentation from evidence
	Summative project assessments	Evaluate		Construct explanations and design solutions

FIGURE 2

Brief Lesson (format from Tweed 2009) description.

Big Ideas: What Living things need for growth and reproduction.

STANDARDS

- NGSS: 2-LS2-1, 2-LS2-2
- Language Arts: SL.2.5, W.2.8
- Math: 2.MD.D.10, MP.2, MP.5

Language: Students will be able to demonstrate science content through written products

Key Questions: These questions are referred to throughout the entire unit. These are assessed through the final product.

- What is a seed and what does it do?
- How do we help plants survive?
- How do we discover what a living thing needs to survive?
- How can learning be shared with others through writing?

Safety: Review safe lab procedures and practices: Follow direction, no eating or drinking in lab, use materials as directed.

Observation: Engage (30 minutes once a week/every day for at least four weeks)

Each student will have an opportunity to plant his or her own seed. (Flower, bean, or any other seeds of your choice.) Each day or once a week, students will use their hand lenses to observe the life cycle of the plant. The students can create a simple of chart of date, stage of life cycle, and observation/what's happening.

Data collection: This can be as structured as you wish for this observation. I had my students collecting the data on how long it took different seeds to move through the life cycle. The students record their data into their science notebook. This could be in the form of written words, charts, graphs, etc.

Discourse Reveal: Vocabulary is presented without definitions at this point. The students should use their individual ideas about the words at this point to have a personal connection to the words.

Vocabulary

life cycle words - seed, germination, stem, roots, leaves, flower, pollination, and seed pod

sunlight reproduction disperse pollen

Wonder: Explore (one 30 minutes class time)

This part of the lesson will come from the wonderings that the students still have about plants. Hopefully these wonderings will lead toward the planned experience of the Fast Plants. The students will need to discuss with their group and individually while recording their wonders in their science notebook. The students are then grouped based upon their wonders to be able to research and answer their wonders that they are connected to.

Sample wonderings:

- How long does it take for the plant life cycle?
- Is the life cycle the same for all plants?
- How does pollination work in nature?

FIGURE 2

Brief Lesson (format from Tweed 2009) description.

Experience: Explore & Replace (40 days)

Fast Plants (can be purchased through Carolina Biological Supply)

Students planted the seeds and were asked to make predictions on how long the seeds would take to germinate based upon the seeds we planted before. As a class, have conversations on the importance of each part of the plant light house (the watering system, the UV light, and aluminum foil—if you made your own). The students will need to make daily observations of the plants and collect data. The items to collect data on would be based on team wonderings but might include the height of the plant, when did they develop stem and roots, leaves, flowers, and seed pods. When all the plants start to flower, you will start to show the students how pollination works in nature.

Replace: their everyday language with the scientific language needed for the data collection takes place at this time. Modeling when the scientific word should be used.

Explain & Reposition: At this time most of the student's wonderings should have been answered through the experience; but, if there are still some wonderings, the students should do research to gain that content knowledge. Wonderings should be divided among groups for shared learning. Reposition of the vocabulary should be taking place at this time. Instead of just replacing the everyday language with the scientific language, there should also be a reposition of how the vocabulary is used. For example, the everyday language they use "make new" replacing would be saying reproduce, but reposition would be modeling how to use it in conversation.

Elaborate: Sharing answers to wondering questions and data and analysis. Each group will be able to share the answers to the wonderings to the whole class to learn from each other.

Evaluate (formative): science notebook posts, worksheet, handout, exit tickets, class and team discussions.

Learning connected to Wondering: Reloading the vocabulary could be as simple as doing a review of the words and definitions, reminding students of their experiences with the content and vocabulary. Students can show their understanding of the content and vocabulary through poems, stories, or performances using correct science terms, and illustrations of learnings. There are several types of book publishing companies to use in this process. The one I found is using Blurb. Blurb is a free software that allows you to put the book together or the students can also do this.

Evaluate (summative): The products created for the book could the summative assessment for the lesson. A rubric would be the best tool to evaluate the writing. The criteria would be correct use of science content, use of scientific vocabulary, and data and experience from observations. Based upon the needs of your classroom, other criteria could be added to the rubric to assess language arts and math.

Resources

Blurb

https://secure.blurb.com

Fast plants build plant system

https://fastplants.org

Project Lead The Way

www.pltw.org

cess reviews and anchor charts will be enough for later units, and student autonomy will be part of a successful concluding unit.

Formative assessments are the checkpoints and redirect stages of the unit. Does the wheel need to return to earlier in the process to support success? What supports need to be added to build student success? Is this the right path for this point in instruction, grade level, developmental stage? Based on formative assessments, what path changes are needed?

Learn is the summative assessment phase of the model.

Shared Wondering is the process of creating the products to demonstrate learnings that will be used as evidence of growth and learning. Teams collaborate to define and refine the evidence necessary to demonstrate learning outcome. Again, this will look different depending on the placement in the sequence of units. Scaffolding, modeling, and collaboration within the whole class will be necessary for early units and more autonomy will demonstrate growth with additional units.

Summative Project Assessments are the actual sharing of what was learned and what wonderings continue. Books, presentations, PSA, gardens, musical albums, fliers, science fairs, and science nights can all be used to support all learning styles and intelligences. The types and sophistication of products will grow as more units are explored.

FIGURE 3

Plant image.

PHOTO COURTESY OF THE AUTHORS

WHAT DOES THIS LOOK LIKE IN A CLASSROOM?

For our pilot we used a Project Lead the Way lesson (see Internet Resources) on structure and form of plants as the guided inquiry for the Observe phase. The students grew their own plants and observed and recorded data. Group discussion generated the questions found in the sample lesson plan (Figure 2). Student teams were formed based on the questions that were of personal interest and given the opportunity to grow and observe *Fast Plants* to research their "wondering" questions. The teams then generated a group project shared with the whole class as the "Learn" part of the model was implemented. The project unit might seem like it is much longer than most teachers have time for, but the unit addresses all three dimensions of NGSS and supports ELA and math, so it allows for more time as it is interdisciplinary in nature. This unit was completed in a STEM specials classroom that allows time to explore topics in more depth.

CONCLUSION

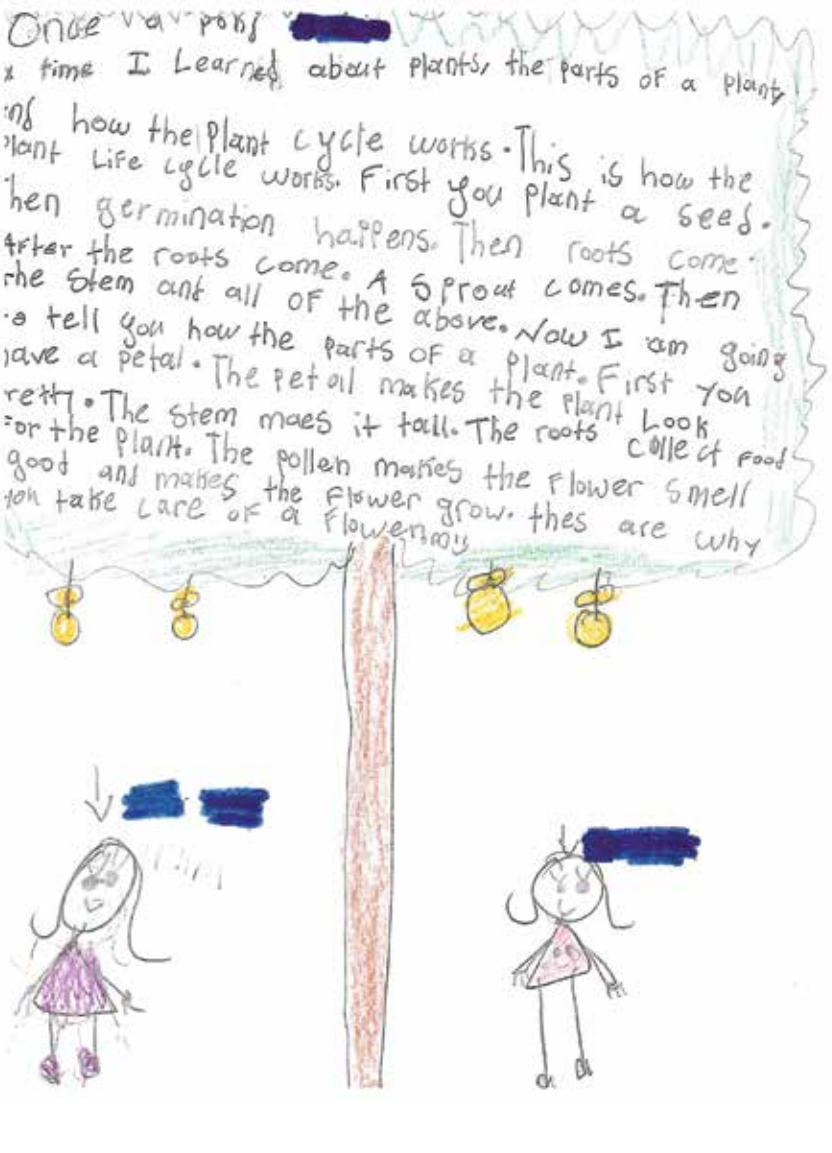
The OWL designed unit was meaningful and engaging for the students. They enjoyed being able to observe, and wonder more about their observation, and lastly to demonstrate their learning through an engaging creative product. The structured observation provided the gateway to building personal learning. The pinnacle of the unit was the student experience in the wonder stage of the OWL, where the students took charge of their learning. Additionally, the wonderings also provided the teacher insights into the

students' preconceptions, misconceptions, and previous learning gaps. The structured use of questions and language to convey their students' thoughts served to guide additional instruction and topics for future study.

The end of unit assessment demonstrated student growth. The students were able to express their learning creatively through writing about their experience (Figure 4). The students had open choice on the structure of the poems or stories but were given a rubric (see NSTA Connection) to make sure they demonstrated their learning. The products were compiled into a class book. We used Blurb to publish our books, but any student book publishing company would work. Overall, high-achieving as well as struggling learners were actively engaged and took responsibility for their learning and expressed interest in what would be their next task. We plan to build a research basis of the effectiveness of the complete design as more lessons are developed and taught. ●

FIGURE 4

Writing sample.



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INTERNET RESOURCE

Project Lead the Way
www.pltw.org

NSTA Connection

Download the rubric at *www.nsta.org/SC0220.*

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