Science

Evaluation Brief, 2017-2018 School Year

AESD ASSOCIATION OF EDUCATIONAL SERVICE DISTRICTS

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Supporting Washington's Schools and Communities.

Kauffman & Associates INCORPORATED

Dear ESD and OSPI Colleagues,

It is with great pleasure that we share this Evaluation Brief to communicate what we have learned thus far in our exploratory pilot study focused on measuring the "Influence on Student Mastery of Content" in the OSPI/AESD Professional Learning Network Theory of Action.

The OSPI/AESD Professional Learning Network Theory of Action was developed collaboratively by ESD Regional Coordinators. The documents reflect the comprehensive and strategic approach to getting timely information from OSPI education leaders into the hands of our local teachers to improve student learning. It is the way we tell the story between the actions of the Regional Coordinators and teacher and student outcomes.

This brief provides an example of the type of information we are gathering to probe the assumptions in the Theory of Action that specifically focus on Regional Coordinators' work. By studying one middle school science teacher, the through line from Regional Coordinators' work to student mastery of content is illuminated.

Together, let's celebrate the collective effects of OSPI/AESD professional learning sessions on teachers and students across Washington state.

Sincerely yours,

Gene Sharratt, AESD, and Kathe Taylor, OSPI

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Student Learning Exploration

Throughout Washington state, Regional Content Coordinators serve as the conduit of information from our state education leaders to school districts across 71,362 square miles, spanning the snow-capped mountains of the Cascades to forested islands in Puget Sound to the rich agricultural fields in Eastern Washington. The Regional Coordinators work diligently in their Educational Service District (ESD) Regions to take common resources from the Office of Superintendent of Public Instruction (OSPI) addressing equity, standards, and assessment to help teachers improve instruction and student learning. They offer courses throughout the year and work within schools supporting instruction through professional learning communities, classroom demonstrations, and embedded coaching practices in cooperation with teachers, instructional coaches, and administrators.

Last year, work began with the collaborative development of the OSPI/AESD Professional Learning Network Theory of Action. Over the course of a month, Regional Coordinators from all nine ESDs and four content areas were guided through a series of conversations. With diligent attention to detail, they passionately shared the multi-faceted nature of their work and intended outcomes. After synthesizing volumes of information, Kauffman & Associates, Inc., (KAI) created the resulting Theory of Action that depicts the relationship between Regional Coordinators' actions to desired outcomes. This framework allowed for an evaluation to test assumptions about OSPI/AESD Professional Learning Network activities. By collecting data to confirm, modify, or refute these relationships, the evaluation aims to ground practice in a clear analysis of what is working well and what may need to be improved.

Using a participatory approach to conduct research for this brief, KAI's Dr. Janet Gordon collaborated with teachers to explore how their engagement in OSPI/AESD professional learning has influenced students. Dr. Gordon used quantitative (assessment scores, surveys, classroom work) and qualitative (videos, audio, interviews) data to tell the story of the teachers' cycle of inquiry, from professional learning to classroom implementation to adjusting practice and the influence on students.

Spotlight — Science

Stephanie Ball is a seventh and eighth-grade teacher at Cashmere Middle School in Cashmere, WA, which is served by ESD 171 in Wenatchee, WA. Cashmere Middle School is a small rural school located in central Washington 13 miles west of Wenatchee. Cashmere serves fifth- through eighth-grade students divided among 31 teachers. Students come from the following racial backgrounds: 55% White, 39% Hispanic, 4% two or more races, with remaining students identifying as African American and American Indian. Of these students, 47% use the Free or Reduced Lunch program.

Ms. Ball is active in professional learning at her ESD, has been involved in the Fellows Program and Science Leadership Network. These opportunities have complemented her ongoing quest for knowledge about instructional strategies, student engagement and formative assessments. She found the Next Generation Science Standards (NGSS) training invaluable, as her school is transitioning from a traditional letter grade-centered approach to a standards-based learning (SBL) approach. SBL is a natural outgrowth of the regular use of formative assessment because the student feedback is focused on whether a student has mastered the knowledge in a standard, and thus emphasizes learning more than grading. SBL shifts the question from "how many points did I earn?" to "how has my understanding improved?" The NGSS sessions also helped Ms. Ball incorporate science and engineering practices into her lessons.

Stephanie Ball, 7th–8th grade Science teacher at Cashmere Middle School in Cashmere, WA

She shared that she learned in the Fellows convenings how to evaluate and develop teaching materials for inclusive science instruction. Inclusive science instruction builds on students' prior interest and identity and leverages their cultural knowledge to facilitate learning. The Science Regional Coordinator at the ESD facilitated professional learning designed to increase teachers' knowledge, skills and abilities to use inclusive science instruction through:

1. Approaching science learning as a cultural accomplishment
2. Relating youth discourse to science discourse
3. Building on students' prior interest and identity
4. Making diversity visible
5. Valuing multiple modes of expression for different learners

Over the years, Ms. Ball has used her ESD and the Fellows Program to support continued refinement of her practice, which has led to improved science learning for her students.

Implementation of Professional Learning

Ms. Ball uses a systematic approach to apply her wealth of knowledge and pedagogical strategies, fueled, in part, by her learnings at NCESD and the Fellows Program. One example is the regular use of formative assessment in conjunction with a four-step approach taught in one of the NCESD professional learnings by author Paige Keeley. This approach helps guide students to re-evaluate their ideas about science phenomena and build a solid foundation of science understanding to excel academically and in everyday life.

Ms. Ball shared her methodology when she taught the unit, Space Systems Exploration.[1] She explained, *"The learning objective of this unit was to develop and use a model of the Earth, Sun, Moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons."* Her four steps and strategies are outlined below.

STRATEGY 1 was used before instruction as an "initial assessment probe, specifically designed to uncover the misconceptions that students brought with them to the classroom about the Earth-Sun-Moon system." Ms. Ball analyzed students' written responses to get an idea of the variety of incorrect understandings, plan scientific investigations to refute misconceptions, and prompt discussion during Strategy 2.

STRATEGY 2 was designed to break down each unique misconception and support each student to confront their own ideas. Confronting incorrect ideas causes cognitive dissonance and provides fertile ground to introduce an alternative idea. Ms. Ball created scientific investigations and classroom experiences that included making models using foam balls and flashlights to inform students' diagrams and responses.

STRATEGY 3 provided learning experiences to reconstruct and internalize new, correct knowledge. Ms. Ball developed "*learning experiences designed to reteach content through notes, drawing, and explaining positions of the Sun, Earth, and Moon."* She used a variety of methods for students to show what they know.

STRATEGY 4 reassessed learning after re-teaching to determine the extent to which students built a more accurate conceptual framework of the Earth, Sun, Moon system.

Influence on Student Achievement

Ms. Ball continually collects student evidence to assess the extent that her classroom instruction has increased students' science understanding. During the Space Systems Exploration unit, she gathered evidence to assess the extent that students developed a more accurate mental model of the Earth, Sun, Moon system. This evidence included students' lab sheets, notes, teacher observations, and formative assessments (pre, mid, post, re-assessment). To demonstrate the strategy step application, the work of one student and Ms. Ball's interpretation of the student's learning is described below.

The student's pre-assessment of the lunar eclipse cycle showed that the student may or may not have a general idea about the position of the Earth, Sun, Moon system during a lunar eclipse cycle. *"She is indecisive and lacks detail, so she is probably guessing here,"* commented Ms. Ball.

[1] Space Sciences Exploration addresses the standard, MS-ESS1-1 Earth's Place in the Universe. To learn more, please visit http://www.nextgenscience.org/dci-arrangement/ms-ess1-earths-place-universe

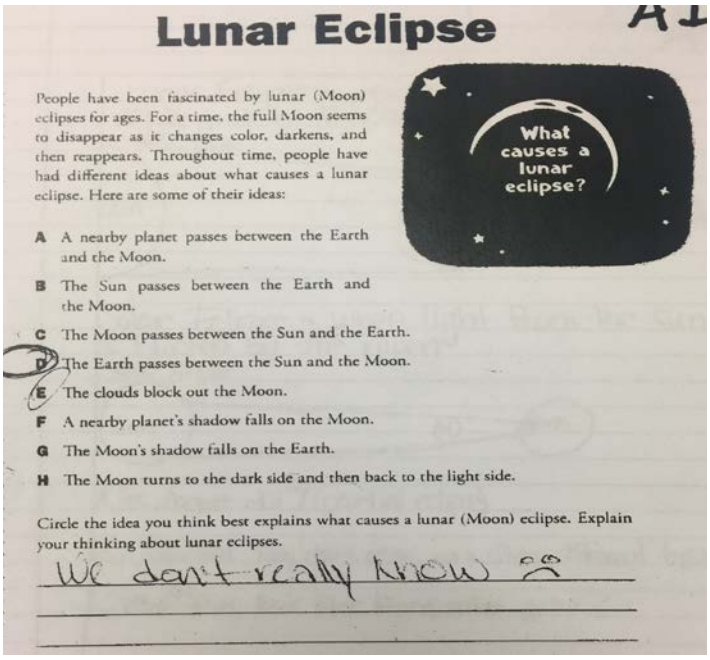
The student's work during Strategy 2 reflects the process of breaking down misconceptions. Ms. Ball shared that the student has gained perspective on the positions of the Sun, Earth, Moon system during a lunar eclipse cycle. She explained: *"But does not include light from the sun in the diagram. This shows lack of clarity and/or understanding that light is a critical component of the system."*

Ms. Ball reflects on the third strategy, when deliberate learning experiences challenge science misconceptions and cause students to reconstruct their knowledge: *"The student's notes show focus on Sun, Earth, and Moon positions, as well as on how light from the sun affects or is affected to create lunar eclipses. This practice was followed by a second activity using flashlights and Styrofoam balls to demonstrate each position. The notes are clear and neatly diagrammed."*

The reassessment of student knowledge, Strategy 4, provides a final opportunity in the cycle to reevaluate growth in understanding. Ms. Ball examined the student's work and stated, *"The student can now distinguish between solar and lunar eclipses and correctly position the sun, earth and moon in both situations. She used arrows to show light from the sun and its effect on the system."* Figure 1 and Figure 2 show samples of the student's work.

Taking a broader look at the classroom level, students' fall and winter Northwest Evaluation Association (NWEA) Measures of Academic Progress (MAP) Science Earth and Space Strand scores appear in Figure 3. Classroom-level data also confirmed the positive influence of Ms. Ball's participation in professional learning on students' science achievement. In 2017,

Figure 1. Strategy 1 – Pre-assessment of lunar eclipse cycle shows student has little knowledge of the Sun, Earth, and Moon system.



Lunar Eclipse

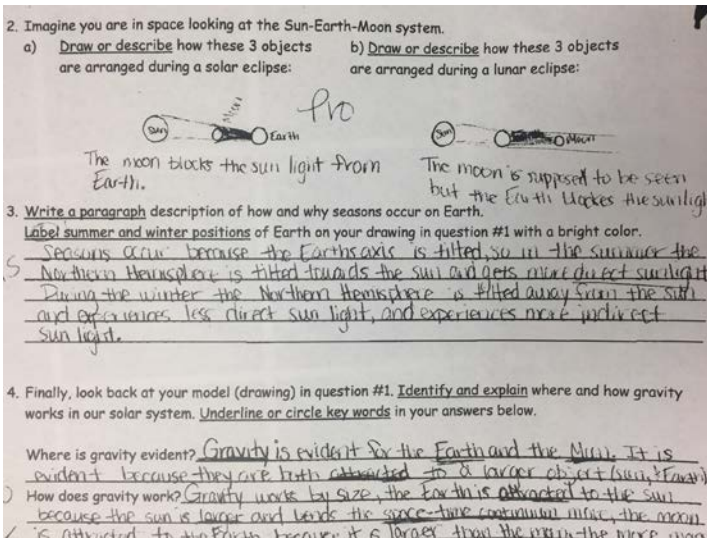
People have been fascinated by lunar (Moon) eclipses for ages. For a time, the full Moon seems to disappear as it changes color, darkens, and then reappears. Throughout time, people have had different ideas about what causes a lunar eclipse. Here are some of their ideas:

A A nearby planet passes between the Earth and the Moon.
B The Sun passes between the Earth and the Moon.
C The Moon passes between the Sun and the Earth.
D The Earth passes between the Sun and the Moon.
E The clouds block out the Moon.
F A nearby planet's shadow falls on the Moon.
G The Moon's shadow falls on the Earth.
H The Moon turns to the dark side and then back to the light side.

Circle the idea you think best explains what causes a lunar (Moon) eclipse. Explain your thinking about lunar eclipses.

We don't really know ☹

Figure 2. Strategy 4–The reassessment shows the student can now distinguish between solar and lunar eclipses and correctly position the Sun, Earth, and Moon.



2. Imagine you are in space looking at the Sun-Earth-Moon system.
a) Draw or describe how these 3 objects are arranged during a solar eclipse:
b) Draw or describe how these 3 objects are arranged during a lunar eclipse:

The moon blocks the sun light from Earth.

The moon is supposed to be seen but the Earth blocks the sunlig

3. Write a paragraph description of how and why seasons occur on Earth. Label summer and winter positions of Earth on your drawing in question #1 with a bright color.

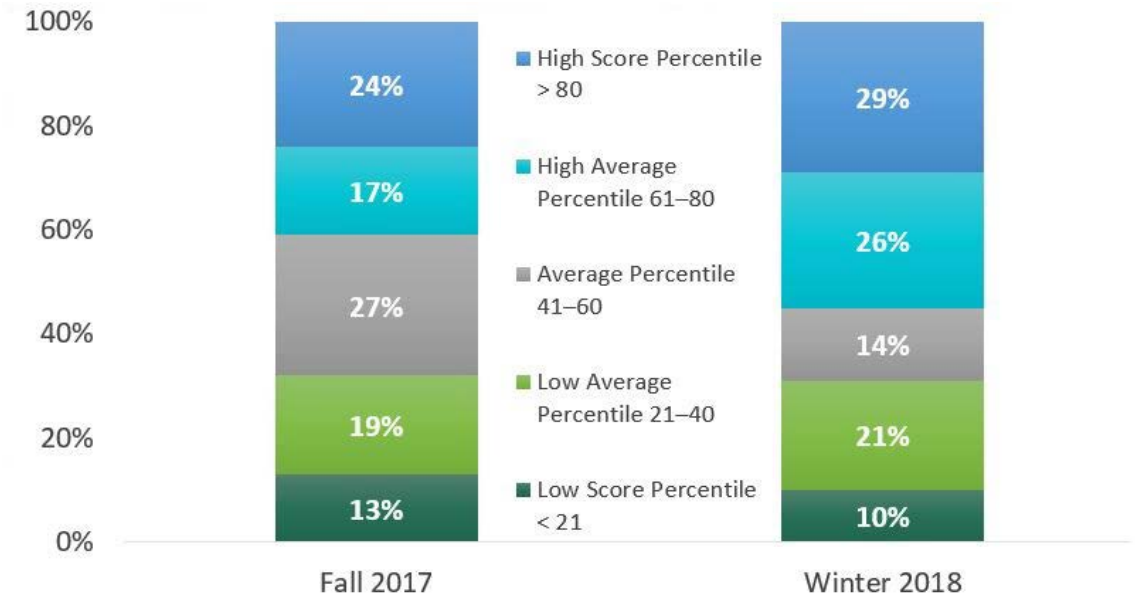
Seasons occur because the Earths axis is tilted, so in the summer the Northern Hemisphere is tilted towards the sun and gets more direct sunlight. During the winter the Northern Hemisphere is tilted away from the sun and experiences less direct sun light, and experiences more indirect sun light.

4. Finally, look back at your model (drawing) in question #1. Identify and explain where and how gravity works in our solar system. Underline or circle key words in your answers below.

Where is gravity evident? Gravity is evident for the Earth and the Moon. It is evident because they are both attracted to a larger object (sun, Earth)
How does gravity work? Gravity works by size, the Earth is attracted to the sun because the sun is larger and bends the space-time continuum more, the moon

students completed two administrations (fall 2017 and winter 2018) of the NWEA MAP Science Assessment. On the Earth and Space Science Strand, students' scores shifted upward. In the beginning of the year, 41% of the students were above the 60th percentile. By winter, all students had made gains in science achievement, with 30% more of the students scoring above the 60th percentile. Additionally, the mean Rasch Unit (RIT) score increased from 212 to 217.

Figure 3. NWEA MAP Earth and Space Science Strand Scores, Fall 2017 and Winter 2018



Next Steps

Dr. Gordon will continue to explore the influence of teacher professional learning on students with the larger group of ELA, early learning, mathematics, and science teachers. Also included in the evaluation are school administrators who are Fellows and Instructional Coaches. This analysis will be included in the year-end evaluation report. Factors that professional development participants identified as having shaped their classroom practices and, in turn, their students' learning will be shared. Learning from this exploratory pilot will prompt action in the upcoming 2018-19 evaluation and inform next steps to maximize the OSPI/AESD Network's investment of time and resources and set the course for teacher and student success.