

TITLE

***Observing for Evidence of Learning*—A comprehensive system of teacher  
collaboration toward a common vision of how students learn science**

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**Abstract**

With rigorous Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS) in place, school districts are now faced with the challenge to provide adequate professional development for their teachers (Stark, 2013). While research suggests that professional learning communities play an important role in improving instruction and student learning (Vescio, Ross, Adams, 2008), forming a district-wide systems that successfully support such ongoing, collaborative, and school-based professional development is not an easy undertaking. This article shares lessons learned from creating such a system in numerous school districts to inform professional development providers and administrators who are aiming to implement effective professional development for all their teachers.

## Introduction

*Observing for Evidence of Learning (OEL)* has been developed as a comprehensive professional development series for secondary science teachers and has been implemented over the last ten years in eight regional school districts, from large and urban to small and rural, affecting 350 science teachers in 44 middle schools and 14 high schools. OEL is now expanding to math teachers in some of the same districts.

In the late 1990s, school districts in the Puget Sound region of Washington State adopted new inquiry-based science instructional materials as the core curriculum. Over time, it became clear that schools needed support for their secondary science teachers to overcome the implementation plateau; i.e. to improve the use of their science materials beyond a mechanical level, in an effective way for all students (Wallace, Blase, Fixsen, and Naoom, 2008; Silver, Ghouseini, Charalambous, and Mills, 2009). In 2005, OEL was designed as a professional development series for teachers to collaboratively learn to better target standards and to engage all students in more-rigorous science. Two studies demonstrated that after several years of OEL, students' test scores on state tests increased, with high-poverty urban schools seeing eighth-grade students' science test scores increase from well below to above the state average (Weaver & Lewis, 2010; Weaver, Lewis, & Gandhi, 2012).

We found that keys to the success of OEL professional development were a common instructional vision of how students learn science and a well-defined process for teacher collaboration. Contributing factors were building trust among teachers for putting instruction and student learning under the microscope, formed through the leaders of OEL in long-standing community partnerships with the schools; integration of instructional coaches, facilitators, and content experts to support teachers; and a high level of teacher participation over several years - a long enough time to make instructional shifts. Laying a foundation for program sustainability along the way can ensure teachers' professional growth in the long term through distributed knowledge.

## Results of Research on OEL Outcomes

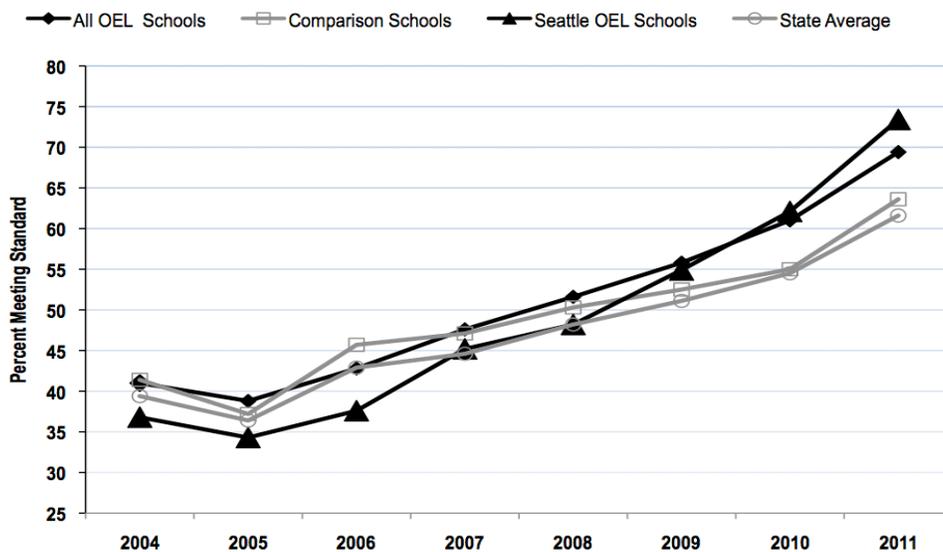
Between 2006 and 2012, the implementation and efficacy of OEL professional development was studied in 26 middle schools in five school districts in Washington State. These districts included Seattle Public Schools, a large urban district with a diverse student population (nearly 50,000 students; about 40% FRM<sup>1</sup>), and four smaller urban or suburban districts (9,000–19,000 students; FRM ranged from 20% to 70%). The two studies (Weaver & Lewis, 2010; Weaver, Lewis, & Gandhi, 2012) explored the extent to which teachers' participation in OEL resulted in improved student achievement as measured by the statewide science assessment, and how professional climate and teaching practices were affected.

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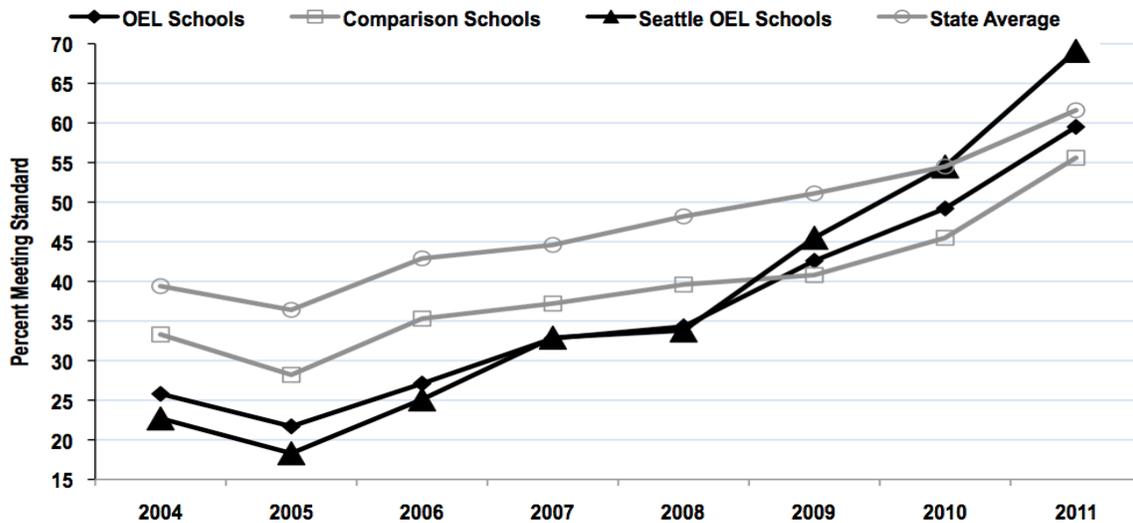
<sup>1</sup> Free and Reduced-Price Meals.

### Gains in student achievement

The first study (Weaver & Lewis, 2010) found that in OEL schools, eighth-grade students' improvement on Washington's statewide science assessments exceeded both that of the comparison schools and the average of all schools in the state. Figures 1 and 2 show that this difference became statistically significant in 2010, four years after the first OEL cycles started in fall of 2006. The overall increase in student achievement was largely due to the gains of students in OEL schools where more than 40% of students qualified for FRM. Prior to OEL, these schools scored far below their comparison schools and below the average of all state schools. After three years of implementing OEL, these schools started to outperform the comparison schools. Seattle Public Schools using OEL and with more than 40% of students qualifying for FRM closed the 18% achievement gap by scoring above the average of all state schools.



**Figure 1. Percent of students in OEL and non-OEL schools who met or exceeded standards in Washington State's eighth-grade science assessment, 2004–2011.** OEL = Observing for Evidence of Learning. OEL Schools:  $n = 21$  in 4 school districts; Comparison Schools:  $n = 21$ ; Seattle OEL Schools:  $n = 11$ ; State Average: all schools. OEL professional development began in Fall 2006. The difference between the set of OEL schools and the set of comparison schools was statistically significant at  $p < 0.05$  in 2010 and 2011.



**Figure 2. Percent of students in OEL and non-OEL low-SES schools who met or exceeded standards in Washington State’s eighth-grade science assessment, 2004–2011.** OEL = Observing for Evidence of Learning; SES = socioeconomic status. Low-SES schools are defined as those that served a student population with a Free and Reduced-Price Meals rate  $\geq 40\%$ . OEL professional development began in Fall 2006. Low-SES OEL Schools:  $n = 11$ ; Low-SES Comparison Schools:  $n = 11$ ; Low-SES Seattle OEL Schools:  $n = 6$ ; State Average: all schools (not only low-SES schools).

### Improved collaborative culture

Teacher surveys and interviews revealed that the OEL professional development promoted a collegial and supportive atmosphere. Teachers participating in OEL provided increasingly high ratings of team climate and school climate. Teachers’ also expressed increased appreciation for the knowledge and skills of their peers, for honest and constructive discussions, and for equal involvement and shared ownership in lessons and practices. As one teacher reflected, “We are a much more stable science department, and several teachers changed their minds about leaving teaching, since we support each other now.”

### Change in teaching practice

In interviews and informal conversations, teachers provided concrete example of generalizations to practice resulting from OEL. These included focusing on questioning strategies, increasing students’ opportunities to talk with each other, modifying use of science notebooks, and developing new formative assessment strategies. In addition, teachers’ skills and content knowledge expanded. Facilitators supported this assessment: “I personally have seen growth in numerous individual science teachers in many buildings in our district as a result of OEL.” A mentor for novice teachers in Seattle Public Schools saw OEL as especially valuable: “Because the teachers I am mentoring

have this professional development opportunity, they are advancing in their practices with deeper support than I alone can give them.”

### **The OEL Vision and Process for Teacher Collaboration**

Most schools fail to capitalize on professional development because they lack “the *internal structures, processes, and norms* that are necessary to pick up the knowledge and deploy it in classrooms” (City, Elmore, Fiarman, & Teitel, 2009, p. 9, italics in original). OEL, driven by theory of learning and professional development design (Borko & Putman, 1998; Bransford, Brown & Cocking, 2000; Garet, Porter, Desimone, Birman & Yoon, 2001; Lewis, 2002; Loucks-Horsley, Love, Stiles, Mundry & Hewson, 2003; Stigler & Hiebert, 1999), and by continuous program evaluation and feedback from all participants offers a practical solution. As a solution, it offers not quick fixes, but instead suggestions for creating a climate that will slowly yet effectively implement NGSS and CCSS.

Central to OEL is its instructional vision (adapted from Banilower, Cohen, Pasley, & Weiss, 2008), which improves teaching and deepens student learning of the NGSS by

1. eliciting students’ preconceptions, and displaying them as a range of ideas that form a base for the unit of study;
2. engaging students intellectually with essential and relevant science content;
3. providing experiences for students to collect and examine scientific evidence;
4. scaffolding students’ use of evidence to formulate a new understanding of science concepts; and
5. guiding students to reflect upon their new learning.

Teachers work to translate this vision into classroom practice during OEL cycles. For each OEL cycle, teachers are released from classroom teaching for two nonconsecutive school days (see table 1). OEL has been effective in two formats: cross-grade-level teams from one school (e.g., grades 6–8 or 9–12), or cross-district teams teaching the same grades. Teacher collaboration is facilitated by two leaders who are trained for their roles: a teacher-facilitator, who uses the OEL protocol to guide the team through each phase of the OEL cycle; and a content expert, who ensures scientific rigor. Teachers engage in three to four OEL cycles per year, at strategic points in the core curriculum.

**Table 1. Contents of an Observing for Evidence of Learning (OEL) professional development cycle**

	OEL Cycle Day 1	OEL Cycle Day 2
<b>Protocol Phases</b> (2 nonconsecutive days)	<p><b>Lesson Examination</b> (1.5 hr)                      Teachers examine the curriculum, share evidence of student ideas, and select a sequence of lessons that has presented challenges for students' learning.</p> <p><b>Science Content Study</b> (1.5 hr)                      A content expert joins teachers to probe the science content and pedagogical content knowledge necessary for the selected lessons. Together, they clearly identify the key science concepts and write rigorous learning targets. This phase builds teachers' confidence and competence to teach key concepts, ideas, and practices.</p> <p><b>Lesson Refinement</b> (3+ hr)                      Teachers refine lessons, integrating the OEL instructional vision into strategies that support students' mastery of specific science learning challenges. The goal is not to create new lessons but to improve the existing curriculum toward meeting the Next Generation Science Standards.</p>	<p><b>Lesson Delivery and Observation</b> (1.5 hr)                      One teacher implements the collaboratively revised lesson while the others make detailed observations: sitting with a student group; noting who speaks and what is discussed or done; and recording evidence of students' understanding or struggle points. All teachers share responsibility for the lesson design, and there is no focus on the classroom teacher.</p> <p><b>Individual Reflection</b> (0.5 hr)                      Teachers individually reflect on their own observations and begin to make inferences about the instruction.</p> <p><b>Debrief and Generalization to Practice</b> (4+ hr)                      Teachers discuss the evidence collected to identify connections between student understanding and aspects of the lesson design. The OEL protocol guides teachers to connect evidence of learning to the instructional vision. From this synthesis, teachers form generalizations about how the effective instructional moves can be applied to all their classrooms.</p>
<b>Ongoing</b> (daily)	<p><b>Individual Implementation of Generalizations</b>                      Teachers consider effective CK and learning strategies for their own lesson planning and enact their team's generalizations in individual daily practice. In this way, the instructional vision becomes a central element in the classroom. All teachers and administrators are given easy access to the generalizations documents and the refined lesson plans. In addition, teachers continue to meet in professional learning communities, analyze how student work reflects previous generalizations, and further their expertise in teaching for conceptual change. The overarching goal is to advance students' understanding of science concepts and practices in accordance with the NGSS.</p>	

OEL cycles bear both, affordances and challenge, for teachers' collaboration. During the first day of the OEL cycle, for example, teachers tend to implement the *Lesson Examination* and *Lesson Refinement* phases (table 1) with fidelity and to recognize their merit: "It's very valuable, because it is stuff you wouldn't be able to think of on your own. [...] to really get it down why we are doing the lesson, and what do we want them [the students] to get out of it. ... Because we usually don't have the time to do that." However, some facilitators have pointed to difficulties reconciling different

opinions about the best instructional approach to a given lesson. The biggest challenges have occurred when no content expert was present to support the *Science Content Study* phase. In these cases, the teachers seldom spent time unpacking the core science ideas they wanted their students to learn. Teacher facilitators also identified teachers' reluctance to objectively examine their own content knowledge.

On the second day of the OEL cycle (table 1), the *Lesson Delivery and Observation* phase provides teachers with an opportunity to closely observe students in action and to reflect on the impact of instruction on student learning. This is a powerful experience. As one teacher said, "In the classroom by yourself ... you're too busy with the logistics to inquire into students' learning." We have found that opening up teaching practice to observation by colleagues is a major challenge for some teachers during their first few OEL cycles. However, the collaborative lesson development tends to ensure that all teachers feel responsible for the outcome and view the observations as about the students, not the teacher. Over time, this deprivatization of practice becomes a welcomed part of teachers' professional work. As a middle school teacher said: "I was so nervous that day, I always think what do people think of my classroom. But I liked it and it felt good having people in watching and observing and see what my students were doing."

To better reach all students, lessons refined during OEL often include instruction and assessment strategies that are new to the teachers as well as the students. It requires mature teaching skill to successfully deliver a lesson that does not reflect one's own teaching style. We now recommend that teams beginning OEL select more experienced members to be the observation teacher.

During the *Debrief and Generalization to Practice* phase of each cycle (see table 1), teachers undertake a claim-evidence-reasoning approach to their teaching practice, in just the way that they train students to develop conclusions about science ideas. And they typically develop two to five generalizations. The generalizations are for example instruction moves that increase the cognitive demand of a lesson or enable more frequent formative assessment.

### **Factors that Contribute to Success with OEL**

According to the two studies of OEL, as well as ongoing evaluation and feedback from all participants, several factors contribute to the positive effects of OEL professional development.

#### **Long-standing district-provider partnerships and organizational trust**

The OEL providers have a 15-year history of working with school districts in the region. This consistency creates trust—among the district's administrators and teacher leaders, content experts, and evaluators—in providers' know-how and capacity to carry out long-lasting initiatives. We found that only the long-standing district-provider partnerships achieved the following critical factors: adequate time allotment, alignment to district need, a systemic approach, and attention to program sustainability.

**Commitment from those playing essential roles**

*Professional development providers* ensure that each school district's organizational structure as well as administrators and teachers are prepared for OEL prior to implementation. During implementation, the professional development providers train the science content experts, give technical support to facilitators, and work with school principals and administrators.

*District and school administrative leaders* commit to OEL professional development as their strategy for improving secondary science teaching and student achievement. District administrators agree to allot time for science curriculum leaders and funds for substitutes. School leaders include OEL professional development in their school improvement plans. During implementation, administrators link the work of OEL teams between schools and provide support as needed, such as coordinating requests for substitutes to prioritize OEL cycles. Principals' interest and involvement in teachers' collaborative work has a positive effect.

*Instructional coaches* align the focus of OEL cycles to district and school needs, and act as liaisons between teachers, school administrators, and the professional development providers. This is a vital role. Instructional coaches also (co-)facilitate OEL cycles when possible. This in turn increases the effectiveness of their one-on-one work with individual teachers between the cycles.

The *teacher facilitator* role is also critical to the collaborative process (Weaver & Lewis, 2010; Weaver, Lewis, & Gandhi, 2012). Facilitators follow a structured protocol that focuses on refining existing lessons. When prevented from following the unproductive yet common desire to create new lessons from scratch, teachers have time to include more-rigorous science in the lessons and give students more learning responsibility.

**High level of teacher participation over several years**

OEL was established as mandatory professional development in the districts studied, thus all the teachers had committed considerable time and effort to participating. Ongoing participation in OEL had a cumulative effect on teachers' professional growth and students' achievement. The effect on eighth-grade students' science achievement, for example, became evident after three years of OEL (see figure 2). By the third year, all students tested had been taught science throughout middle school by teachers who had collaborated on instruction.

In early stages of OEL, teachers are getting used to the protocols and the social requirements for collaboration. Teacher facilitators also need time to become successful in their role: "In the beginning it was stressful, it took some effort to keep teachers on board with our OEL goals. However, as time passed ... we grew to appreciate each other as a team working toward improving our student instruction." To reach all students, a systemic design that involves all science teachers over several years is necessary.

### **Engagement of content experts**

Content experts—such as scientists, other STEM<sup>2</sup> professionals, or science educators knowledgeable in the relevant science discipline and familiar with teaching secondary science—have become an indispensable feature of OEL professional development. Content experts join a team during the *Science Content Study* phase and guide teachers’ exploration of the key science ideas of a lesson. In surveys and interviews, teachers valued the experts’ knowledge and insight into accurate and current understanding of science and technology. Also, teachers (re)discovered from these interactions their enthusiasm for teaching more-rigorous science. A science professor who had been involved in educating teachers over many years provided this insight:

The teachers then asked me a number of questions about earthquakes, wave motions, and scales of measurement. ... It went well—I have visited these teachers three times and know some from previous classes, so we have all had a joint learning experience! ... For the geology part of Cat events [STC/MS Catastrophic Events module] these teachers don’t need more assistance. And they were clearly ready to help the new teachers.

### **Laying a Foundation for Program Sustainability**

To continue the growth in student learning, we found that at least five years of strong partnership between the science education community and the school district is needed. This long partnership enables the professional development providers to maintain the integrity of the OEL process while gradually transferring more responsibility to the school district. A gradual shift over time (see table 2) is necessary for this kind of collaborative professional development to achieve sustainability.

During the transition to the district, considerable attention must be paid to three areas. First, understanding and strengthening the factors (e.g., policies, structures, and resources) necessary for districts to take on the responsibility of maintaining an OEL professional development model on their own. Second, creating a pathway for teachers to assume more responsibility for their own professional growth during and between OEL cycles. With increased levels of confidence in one another’s professional work, groups will start to define for themselves the resources and additional support they need. Third, developing and testing new ways for OEL professional development to be extended into other subject matter areas and to become an integral part of the entire district’s collaborative culture.

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<sup>2</sup> Science, technology, engineering, mathematics.

**Table 2. Sustainability plan for an Observing for Evidence of Learning (OEL) professional development model**

		Year 1	Year 2	Year 3	Year 4+	
		<i>Pre-Implementation</i>	<i>Initial to Full Implementation</i>		<i>Maintenance and Sustainability</i>	
OEL PD Providers		Training for districts Training for pilot schools Technical assistance		Technical assistance for schools and districts		Technical assistance
	School District	Lay system-wide foundation for acceptance and commitment to multi-year OEL PD (orientation) Develop implementation plan	Prepare administrators, coaches, and teachers for OEL PD Pilot OEL PD at some sites	All schools run OEL PD routinely and with fidelity District leaders refine OEL PD implementation plan (aligned to district context, based on evidence, including plans for sustainability)		District integrates OEL PD integrated into district-wide plan, with policies and resources in place All teachers continue OEL PD with increasing impact District leaders institutionalize OEL PD (refine implementation plan, align resources for and remove barriers to sustainability)

Major role leading implementation  
  Shifting role  
  Minor role

*Notes:* The table shows a suggested timeline for implementation and the necessary shift in responsibilities. PD = professional development.

**Outlook**

When teachers’ collaborative work is firmly established in school and district, it can connect short-term professional development with classroom implementation. For example, following training on the NGSS or CCSS, teachers can deliberate their newly gained knowledge during OEL Cycles and collaboratively incorporate it into their teaching practices and curriculum. Teachers who are used to ongoing enhancement of curriculum and instruction may find it rewarding rather than threatening to have more-rigorous standards available to guide their work on improving instruction for all students.

**Endnote**

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### References

- Banilower, E., Cohen, K., Pasley, J., & Weiss, I. (2008). *Effective Science Instruction: What Does Research Tell Us?* (1st ed.). Portsmouth, NH: Center on Instruction.
- Borko, H., & Putnam, R. (1998). Professional development and reform-based teaching. *Teaching and teacher education, 14*(1).
- Bransford, J., Brown, A. L., & Cocking, R. R. (2000). *How people learn: brain, mind, experience, and school, expanded edition*. Washington, D.C.: National Academy Press.
- City, E. A., Elmore, R. F., Fiarman, S. E., & Teitel, L. (2009). *Instructional rounds in education: a network approach to improving teaching and learning*. Cambridge, Mass.: Harvard Education Press.
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results from a National Sample of Teachers. *American Educational Research Journal, 38*(4), 915-945.
- Lewis, C. C. (2002). *Lesson study: a handbook of teacher-led instructional change*. Philadelphia, Pa.: Research for Better Schools, Inc.
- Loucks-Horsley, S., Love, N., Stiles, K. E., Mundry, S., & Hewson, P. W. (2003). *Designing Professional Development for Teachers of Science and Mathematics* (2 ed.). Thousand Oaks, CA: Corwin Press Inc.
- Silver, E. A., Ghouseini, H., Charalambous, C. Y., & Mills, V. (2009). Exploring the curriculum implementation plateau: An instructional perspective. In J. Remillard, B. A. Herbel-Eisenmann & G. M. Loyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 245-265). New York: Routledge.
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: best ideas from the world's teachers for improving education in the classroom*. New York: Free Press.
- Stark, R. D. (2013). Year 3 of implementing the common core state standards: An overview of states' progress and challenges. *Washington DC: Center on Education Policy*.
- Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and teacher education, 24*(1), 80-91.
- Wallace, F., Blase, K., Fixsen, D., & Naoom, S. (2008). *Implementing the Findings of Research: Bridging the Gap between Knowledge and Practice*. Alexandria, VA: Educational Research Service.
- Weaver, D., & Lewis, C. (2010). *Observing for Evidence of Learning: 2010 final evaluation report*. Portland, OR: RMC Research Corporation.

Weaver, D., Lewis, C., & Gandhi, E. V. (2012). *Observing for Evidence of Learning in Everett Schools*. Portland, OR: RMC Research Corporation.