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CASE STUDY

FAST FACTS

Participants:
William Baur, Washington State Educational Service District Network OpenSciEd Project Manager/Teacher Leader Vancouver, Washington

Wendy Whitmer, Grade 6 Science Teacher, Lakeside Middle School, Nine Mile Falls, Washington

Washington State Facilitator for OpenSciEd

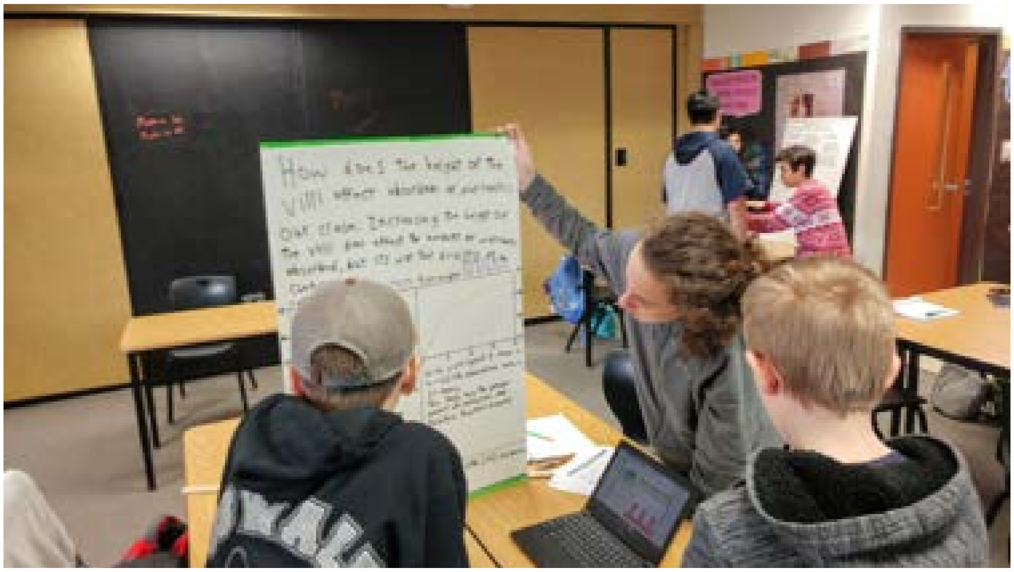
Challenge: Finding a curriculum that implements problem-based, NGSS-aligned science learning that engages students while achieving performance expectations

Solution: Implement OpenSciEd's freely available, high-quality, locally adaptable units

Results: Improved student engagement and ownership of learning; a marked increase in state science test scores

CONTACT:
Carolina Biological Supply Company
Carolina.com/curriculum
curriculum@carolina.com
800.334.5551

OpenSciEd: Two Teachers' Experiences in Middle School Science



William Baur's students collaborate to answer questions they develop about a phenomenon.

To middle school teacher William Baur, initially, obtaining free supplies was the final nudge that motivated him to field-test OpenSciEd science units.

Baur was preparing to teach science at River HomeLink, an alternative middle school in Battle Ground, Washington. Granted, he was already searching for a curriculum that would be a better fit for his students than the existing one and that aligned to the Next Generation Science Standards* (NGSS). So when he learned of an opportunity to field-test OpenSciEd middle school science units—and that it included free supplies for testers—he signed up. What he didn't anticipate was "how grand and big the scope of the vision was for OpenSciEd" and the positive outcomes it would have for his students.

OpenSciEd units are developed to ensure all science teachers have access to freely available, high-quality science units that support equitable learning (OpenSciEd, n.d.). All middle school units have been identified as Quality Examples of Science

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>
> **—William Baur**

Lessons and Units, and most have received the NGSS Design Badge—the highest rating of excellence from the rigorous Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for Science (NGSS 2022).

Baur began field-testing the grades 6 and 7 OpenSciEd units with students at River HomeLink in 2018. He was able to implement the units in an in-person classroom initially and then later remotely—first due to a measles outbreak and later as a result of the COVID-19 pandemic. Then in the 2021–22 school year, he field-tested an OpenSciEd unit with grade 9 students at Vancouver Public School District's Heights Campus.

Wendy Whitmer, a grade 6 science teacher, had two primary criteria as she hunted for a different science curriculum to use with her students: First, it had to be problem based. Second, it needed to be aligned to the NGSS. OpenSciEd units met both her requirements. Additionally, she notes that because Washington State is deeply involved in implementing OpenSciEd through regional science coordinators and individual districts, a ready-made network of teachers, facilitators, and leaders was available to provide professional learning, support, and help with implementation.

Whitmer field-tested an OpenSciEd unit at the end of the 2020–21 school year and then implemented three units with her students in the 2021–22 school year. She and her teaching team plan to use OpenSciEd as their primary curriculum in the 2022–23 school year.

Begin with Professional Learning

In OpenSciEd units, learning is owned by the students, valuing the knowledge and experience they bring to the classroom as they themselves figure out phenomena that are relevant to them through questioning, investigating, and designing solutions to problems (OpenSciEd, n.d.). This can be a significant shift in instructional practice for teachers. Because of that, both Baur and Whitmer say professional learning was key to helping them prepare.

Baur credits the facilitator in his professional learning in doing an excellent job modeling the OpenSciEd approach of not giving answers to students but instead drawing out students' sensemaking while he and other teachers role-played a classroom setting.

"We did some work around discussion-planning tools that helped us focus on how students talk to each other across the room instead of going back and forth between the teacher and the student," he says. "There are tools that are embedded in the curriculum that were made apparent by the facilitation. You're giving students ownership about the path they are going to take and honoring their questions, validating their questions, and using their questions and their prior knowledge in their realizations to navigate to the next lesson. It was a process, like an evolution."

Whitmer's initial experience was through virtual professional learning led by national facilitators for OpenSciEd in investigating the 6.5 Natural Hazards unit that asks, "Where do natural hazards happen and how do we prepare for them?"

"In their professional development, they give you teacher information but then engage you in the unit as a student, so you really do get to experience the anchoring phenomenon," she says. "What I really like about it is you feel like you have ownership in your brain because of the way the curriculum is developed. So as a teacher, I got to experience that." Whitmer then shared what she learned with her school and her team before introducing it in the classroom.

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Taking It to the Classroom

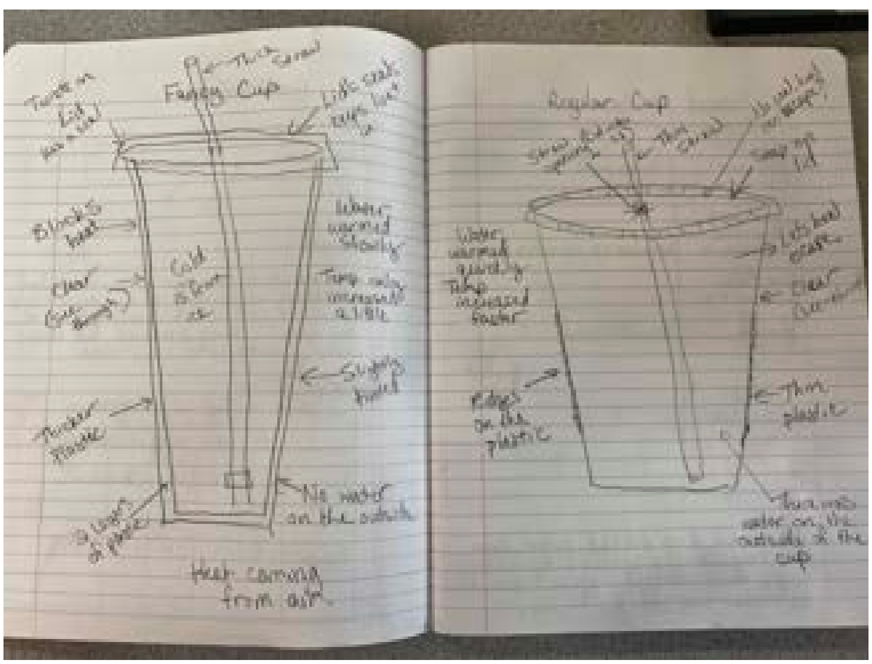
In OpenSciEd, each unit begins with an anchoring phenomenon, engaging students through their noticing and wondering. The phenomena are designed to bring in prior experiences so all students can access the conversation regardless of what science experiences students have had or the educational background of students' families.

Baur began the school year by introducing his grade 6 students to the anchoring phenomenon in OpenSciEd unit 6.6, Cells & Systems. This unit focuses on the question "How do living things heal?" with its anchor lesson introducing an injury case that happened to a middle school student.

Baur asks students about a favorite activity that involves moving the body and then follows up with asking what parts of the body are used when doing this activity. "What sports do you play? Do you like to dance? What are things you do from your culture that involve your body? The kids have all these things they want to share," he says. "It's the first day of school, and we're getting to know each other. It's a good icebreaker."

The next prompt extends the discussion by asking if there has been a time when students were unable to do their favorite activity and how they recovered from an injury. "Everybody has to tell their broken bone story, and the kids are totally hooked," Baur explains. "They're getting to know each other, to feel comfortable sharing all these things about themselves, and that all becomes our collective prior knowledge. . . . There are really important inclusivity conversations embedded within that first anchor phenomenon."

Students' initial ideas and shared experiences provide an opportunity for preassessment. As the unit evolves, commonalities among students' questions begin to develop. In Baur's class, as they considered what it means to heal, one student wondered if plants heal. "I realized we're talking about all living things now," Baur says. "Their minds are exploding. Traditionally, I might have said, 'Plants do this, this, and this,' but instead I posed the question for the rest of the class: 'What do you think?' Then we're talking about the difference between growth and healing, and it's a very rich conversation."



Wendy Whitmer's students developed this model to answer, "How can containers keep stuff from warming up or cooling down?"

During the first few days of the investigation, students dig deeper into their questions, create models, and gather information that leads them to generate questions for a driving question board (DQB). The DQB can take any form, from a sheet of poster board to a bulletin board to shared software. Each student reads a question aloud, posts it on the DQB, and calls on another student who has a related question. This continues in a relay fashion until all students have posted their questions.

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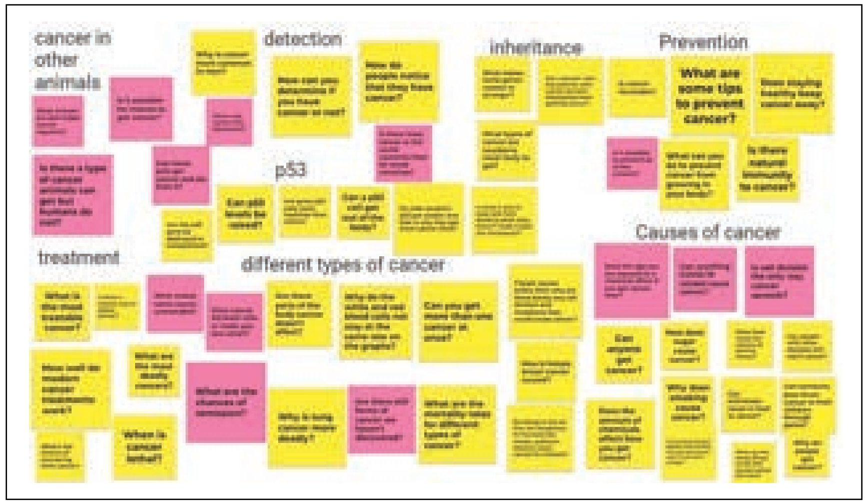
“The end product is we have a list of questions that are grouped in different categories, all generated from students and their initial experiences with the anchoring phenomenon and prior experiences through related phenomena,” Baur says. “The way the units are written, students’ questions are highly aligned to the lessons that follow.”

At key moments throughout the unit’s subsequent lessons, students revisit the DQB to consider the questions answered or to add additional questions.



William Baur also field-tested an OpenSciEd unit focused on cancer, leading his students to develop this driving question board.

When Whitmer implemented her first OpenSciEd unit in the classroom, she needed to be cautious of close student interactions due to the COVID-19 pandemic. Because of that, she chose to teach unit 6.4, Plate Tectonics & Rock Cycling, which incorporates simulations to help answer “What causes Earth’s surface to change?”

The unit is introduced with documentation of a 2015 Himalayan earthquake that shifted Mt. Everest suddenly to the southwest direction. Students also learn that Mt. Everest is steadily moving to the northeast every year and getting taller. This inspires wonders about what could cause an entire mountain to move during an earthquake.

Within the unit, students investigate earthquake and landform patterns. They develop models to answer their questions about how plates collide and spread apart, figuring out uplift and erosion. The unit includes four simulations to explore plate movement, earthquakes in North America, earthquake data, and ancient Earth.

“First, starting my students with an experience that every single person is now familiar with gives them a scaffold to hang all their concepts on,” Whitmer says. “Consistently, they stay invested and want to find out what happened. The kids really loved it, and we [the teachers] loved how it was crafted.”

In her first experience with students, Whitmer said pacing was off. “There’s a lot of teacher learning while the students are learning,” she explains. “So when OpenSciEd says, ‘Take five minutes to do this discussion,’ you tend to take 15. One of the things I had to learn is when it says five minutes, really truly take five minutes. What OpenSciEd does is circle back around, so every concept is revisited in different ways. It’s okay that your kids don’t get it the first time, because they’ll get it later.”

Since OpenSciEd uses the same instructional routines, norms, and procedures in every unit, Whitmer says students quickly become accustomed to the routines and are able to dive into instruction quicker. Because all her students can relate to the anchoring phenomena, she adds that a level of equity is established.

“Every student has different ways of learning and knowing, and using familiar experience allows each student to grow their own connections with their own experiences,” she says. “Also, because students are asked to identify related phenomena and then build their own driving question board, students have ownership of their learning.”

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Ability to Modify Units

OpenSciEd encourages teachers to copy the resources and modify them to suit their needs. But as a field-test teacher, Baur didn't deviate from the OpenSciEd units as they are presented. "You had to see if this material was going to work for students, and if we tried to put our spin on it, then it wouldn't be a valid experiment," he explains. "It forced me to say I'm going to teach these lessons the way they're designed. If it fails or flops, then that's good feedback for the curriculum developers."

What he discovered was that, more often than not, the lessons were successful and guided him to try new strategies. "Putting students in a circle and having them talk about something, I would in the past want to direct that conversation," he says. "There is a lot of control I had to let go of. What I found is I grew through that process." As Baur became more confident in teaching the units, he learned to adapt and supplement the strategies to further engage his students and better their experiences.

In Whitmer's past experiences with curricula, she was told to implement with fidelity. "If you didn't, you were told your students aren't going to learn," she says. "OpenSciEd is different . . . . From the beginning, I was told it's okay to do your own thing. So we modify to reach our particular group of kids."

"I tell students, 'I'm teaching you skills because you all have devices at your fingertips. I'm teaching you practices. I'm not teaching stuff.' And that's been really helpful for kids and is definitely a different perspective as far as education and teaching."—**Wendy Whitmer**

As an example, Whitmer says she implemented a grade 8 unit, 8.1 Contact Forces, that asks, "Why do things sometimes get damaged when they hit each other?" What the unit missed for her students was Newton's laws of motion, so she supplemented the unit at appropriate opportunities. "I find it interesting with OpenSciEd that you are publicly given the freedom to modify to some extent to match your students and teaching style," she says. "I feel like the curriculum gives lots of opportunity to do that."

Student Reactions

From students' perspective, Baur says, "Me not giving any answers and referring back to their questions drove them a little bit crazy for a while but motivated them to want to find out." He adds that norms embedded in the curriculum help students feel comfortable about sharing in conversations and feeling safe in critiquing the science idea of another student.

In Whitmer's experiences, students' reactions varied among the students. "A lot of kids enjoy feeling like they're designing the curriculum," she says. "Even though everything is in order and given to me as a teacher, I tell students, 'Hey, you guys have this idea.' So they come up magically with this whole lab that we can do tomorrow." But other students just want her to provide answers or feel like they can find the answer on the Internet.

"You have to be really careful teaching science that you're not just teaching facts," she says. "I tell students, 'I'm teaching you skills because you all have devices at your fingertips. I'm teaching you practices. I'm not teaching stuff.' And that's been really helpful for kids and is definitely a different perspective as far as education and teaching."

Challenges to Overcome

Baur's challenges primarily evolved from teaching during the everchanging learning environments resulting from the

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pandemic. He had the advantage of in-person classrooms initially, then professional learning through video conferencing in June 2020 helped prepare him to teach remotely that fall.

"Because I taught sixth, seventh, and eighth grades, I had students who had experiences with OpenSciEd in person with me, so it was easier to transition to remote learning and to continue the learning progression through COVID," he says. "It showed up in their [Washington Comprehensive Assessment of Science] test scores. The year before I taught middle school OpenSciEd, the pass rate was 54 percent for the eighth-grade test. The pass rate this fall [2021] was 76 percent." Baur attributes the "unique level of success" to students' ability to apply the practices they've experienced through OpenSciEd units to problem-solve on the state test.

Whitmer finds assessment to be her biggest challenge. "It's exceedingly difficult to assess," she says. "The assessments they have for sixth grade are actually fantastic, but they're all summative. Some of the assessments will have one to two pages of reading before getting to the question. Because of COVID, my kids are at least a full year behind . . . so those assessments have blown them away. We've had to heavily modify to try to figure out how and what to assess."

She notes that OpenSciEd has a project through the University of Colorado and Washington State to develop more tangible assessments and more interim assessments that students can access and "not have a huge amount of front matter to wade through." Additionally, companies that include Carolina Biological Supply Company have partnered with OpenSciEd to create certified versions of the units that are more teacher friendly. Carolina Certified Versions of OpenSciEd for Middle School are available for the 2022–23 school year.

Final Takeaways

Baur can't emphasize enough to take advantage of professional learning opportunities. OpenSciEd offers professional learning resources to introduce the materials and implement the units (OpenSciEd, n.d.), but Baur recommends to also reach out to an educator who has experience teaching the units for guidance.

A benefit of OpenSciEd, Baur reiterates, is everybody has access to the learning materials. "But just downloading a unit and turning around and teaching it in your classroom, that's making your life harder than it needs to be," he explains. "Lack of professional development is the biggest barrier to successful implementation."

Whitmer advises to be prepared for the first unit to take much longer to teach than anticipated. After that, strive to follow the pacing guide closely but feel free to modify to fit your teaching style and students.

"Just remember, all the concepts and all the skills are revisited through the unit," she says. "Use the kids' own experiences—give them that ownership of learning—because they just become so much more invested."

References

NGSS Lead States. 2022. Next Generation Science Standards: For States, By States. "Design Badge Materials." Accessed July 2022: https://www.nextgenscience.org/badgeunits.

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