Center for Strengthening the Teaching Profession
CSTP

Science education in Washington's elementary schools: A system at risk

What kind of supports, conditions and experiences are necessary for elementary teachers in Washington to improve their science teaching? The Center for Strengthening the Teaching Profession commissioned Inverness Research to answer this question.

Inverness focused its research on teachers who are working on getting better at teaching science. The data in this study were drawn from 34 individual interviews with teachers identified by nomination as being "in the process of improving their science teaching" and from a survey disseminated to all National Board Certified Teachers in the state with an elementary education emphasis, with 123 completed responses. These teachers are not representative of the total elementary workforce currently teaching science, but they offer the perspective of seasoned, experienced professionals who are dedicated to improving their teaching.

The findings from this survey are presented as a lesson on the current state of science instruction — a lesson constructed with selected Washington state science standards. The science standards are drawn from the K–12 Washington State Science Standards (First Public Draft 2008).

Excerpts from Washington State Science Standards (First Public Draft 2008)

4–5 Systems
Systems contain subsystems and are themselves parts of larger systems.

K–1 Physical Science
Some forces act by contact and other forces act from a distance.

9–10 Systems
In complex systems, entirely new and unpredictable properties may emerge.

A science lesson for policymakers
The current state of science instruction

- K–12 education in Washington state is a complex system, and elementary science education is part of that larger system.
- With increases in the competitiveness of other world economies and changes in the earth's regulatory systems, Washington's businesses, citizens and policymakers recognized that young people graduating from high school would need higher levels of science knowledge and skills.
- A combination of forces — the creation of science standards, the requirement of a science test at 5th grade, the development of a statewide system of curriculum implementation, and funding from the National Science Foundation and other sources — established "a solid foundation for elementary science," according to Inverness Research.
- With the somewhat unpredictable economic downturn in Washington state and the imminent adoption of a new, more rigorous set of science standards, science education will be competing for scarce resources when they are most needed to maintain this foundation that required years to build.

"I am absolutely convinced that the United States will retain its economic competitiveness only if we transform the way science and math are taught."

— Carl Kohrt, CEO, Battelle

4–5 Systems
A system can do things that none of its subsystems can do by themselves.

Building a foundation for elementary science takes four to five years in a medium to large district.

- 87% of teachers say there is a schoolwide science program.
- 61% of those who reported that their schools use a published curriculum say all or nearly all of their teachers use it.
- 66% of these accomplished teachers feel they have been well prepared over time and through a variety of learning opportunities to use inquiry, incorporate writing in science, integrate science content to increase reading and math proficiency, help students construct their understanding of science content, and use a problem-based approach.
- While 60% have come to feel effective in teaching their science program, they feel more confident about teaching reading/ language arts, math and social studies than they do science.

2–3 Physical Science
A greater force makes an object move faster and farther.

Professional development and the use of science kits are forces that are improving science instruction.

- Only 6% of the teachers in this study have science as an area of specialty. Teachers who are committed to science and their own professional learning depend on the established curriculum (most often science kits) and professional development opportunities to build the knowledge and skills that give them confidence to teach science.
- 23% of teachers have been working to strengthen their science instruction for over 10 years, 21% for six to 10 years, and 23% for four to five years.
- 88% of teachers surveyed attend workshops and institutes provided by their districts.
- 80% have had some science professional development: typically at least a day.
- Nearly all of the teachers are working in a district that uses science kits with a hands-on, inquiry-based approach.

"I don't have a scientific background … and I think that was really the biggest obstacle, just having no idea what it meant to teach science to 5- and 6-year-olds or what that would look like. In that respect, having sort of packaged curriculum at K–2 was really, really helpful and that is really where I started, just teaching it as it was … . "

— Teacher

4–5 Systems
One defective part can cause a subsystem to malfunction, which in turn will affect the system as a whole.

But science gets trumped by the focus on reading and math.

- Only 5% of teachers surveyed say science is a priority in their district.
- About 3–8% of a student's school week is spent on science. Teachers in this survey spend 45–120 minutes per week teaching science, which they say is about the same amount of time or more as their colleagues do.
- Only one teacher in five has one or more of these supports for development of science skills: coaching, participation in science conferences, science leadership opportunities, release time, encouragement and acknowledgement of their efforts.

"The district changes things all too often to fix something, but then it causes something else to break. Right now we are going through a big math change and a whole new math adoption, and while they are giving teacher support and attempting to make this work, it is causing other things to go by the wayside. A couple of years ago, it was a big literacy push and now that has gone by the wayside."

— Teacher

2–3 Physical Science
There is always a force involved when something starts moving or changes its motion.

Science is more likely to be taught when teachers are personally motivated to teach it — or a locally recognized advocate has championed the cause of science.

- 95% of those surveyed believe children need science to enhance the way they interact with and understand the world.
- 88% are motivated to teach science because of their students' interest in science.
- Some report that science can be an important entry point for students who struggle in other subjects.
- About half (47%) of teachers surveyed are aware of a science "champion," an influential individual from the community or within the district who is a force in pushing for science instruction.

"For me it is the hook that I see for kids. I have seen lots of different kids with different ability levels, different backgrounds, and I can't think of a single kid that I haven't been able to hook into the science and to get them excited about learning."

— Teacher

2–3 Applications
Successful solutions to problems often depend on selection of the best tools and materials, and on previous experience.

9–10 Applications
Perfect solutions do not exist. All technological solutions involve trade-offs in which criteria for a desirable solution ... are balanced against realistic constraints.

Building on the foundation
The future state of science education

State and local policymakers can build on the existing science foundation with three interventions: send a clear message that science is a high priority, strengthen teacher knowledge and skills, and systematically build teacher leadership.

- In the absence of clearly communicated state and local support for science, science instruction relies on individual teacher commitment. State and local district leaders must convey the importance of science learning and assure that high-quality science teaching occurs regularly.
- School level leadership is critical. Principals must promote the teaching of science, schedule for it and support professional growth as new learning is put into practice.
- Teachers must have more opportunities to develop their content knowledge and skill in teaching science (for example, facilitating inquiry). This can happen in a number of ways:
  - Professional development offered by informal science institutions such as the Pacific Science Center or Seattle Aquarium
  - Courses through institutions of higher education
  - District-sponsored efforts that are rich, engaging, complex and focused on content related to the teacher's assignment
  - Initiatives funded through the National Science Foundation, such as the North Cascades and Olympic Science Partnership
- Teachers need systematic, structured supports over time to put into practice what they learn, collaborating with other teachers through such activities as:
  - Lesson study
  - Opportunities to observe others teach or to teach new materials together
  - Instructional coaching
  - Analyzing student work samples
  - Curriculum topic study
  - Reflective assessment and documentation, such as preparing a National Board for Professional Teaching Standards portfolio
- Teachers need collegial, school-based leaders they can turn to. Identify those teachers with a personal passion for science who also have gained knowledge and skills for teaching science, and build their capacity to lead so they can help other teachers improve their instruction.

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