Paper prepared for the National Academies National Research Council Board on Science Education: Literacy for Science in the Common Core ELA Standards and the Next Generation Science Standards.

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The *Framework for K-12 Science Education* states, "an important role of science education is not to teach 'all the facts' but rather prepare students with sufficient core knowledge so that they can later acquire additional information on their own." In life, students will need not only a structure of core ideas to help them acquire new information, but also an organizational framework for how those ideas are connected and a set of skills to help them obtain, evaluate and communicate information. The *Framework* goes on to state that by building "a strong base of core ideas and competencies," that students will leave school better grounded in scientific knowledge and practice and with further interest in science, than if they were taught to memorize a plethora of disconnected topics to be assessed and forgotten soon after. [6]

This "shift" from memorization is often difficult, since many classroom teachers have not been exposed to appropriate pedagogy during their professional development. South Dakota's two largest Universities only require 3 credits for content specific science methods courses for those preparing to be secondary science teachers. This means that the majority of exposure to science instruction comes from the 59-65 credits of lecture-style instruction with only about one separate laboratory per week. This format of education does not allow enough time for the students to perform science at the intersection of the three dimensions from the *Framework*, nor does it always model what should be expected from K-12 teachers. In addition, the state elementary generalist programs usually only offer one science methods course. [1] [2]

The lack of preparation in science-specific pedagogy has led to the development of a capacity building initiative in science instruction based on the vision for science education within *the Framework*. This vision sets the expectation for students to perform science at the intersection of three dimensions. Current concerns include the preparation of science teachers as described above, but also the amount of instructional time for science in grades K-5. Rolf Blank did a recent study of NAEP data which indicates the national average instructional time in elementary science education is just over 2 hours per week. [3] To address these concerns, South Dakota has developed statewide Science Academy trainings to build instructional capacity K-12 and to create an access point for elementary teachers to incorporate more science into instruction.

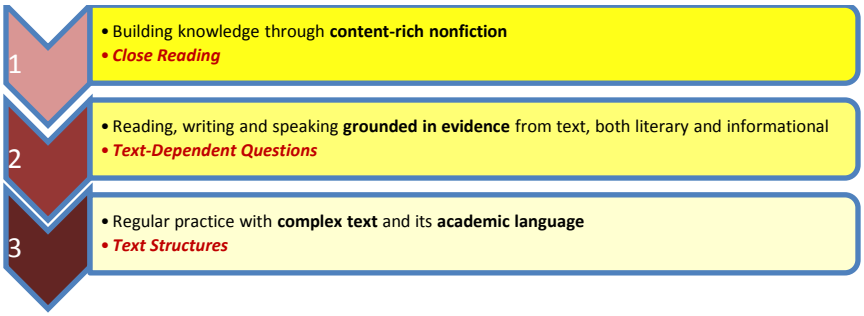
The Science Academy trainings would not exist without Governor Dennis Daugaard's Investing in Teachers package, which was introduced during the 2012 legislative session. This package demonstrated a commitment to education through a significant investment in the teaching profession, including $8.4 million for professional development. A portion of this funding was solely dedicated to academies for science teachers to create a shift in instructional practice to challenge students to higher levels of understanding and performance. Through these trainings, South Dakota will build capacity in science instruction for elementary teachers to build a base-level understanding of student performance at the intersection of the three dimensions and integrated literacy standards and corresponding strategies. [7]

These statewide Science Academy trainings are built to include an instructional planning model which helps sequence science instruction in three stages: Gathering, Reasoning and Communicating. To test this model, a group of grades 9-12 teachers volunteered their lesson plans for analysis. By simply labeling each section of their lessons, it was determined that over 80% of the student performances were asking the students to obtain information (Gathering). The next step in this process to bolster the lessons was to have the teachers incorporate more Science and Engineering practices to get students to construct explanations and arguments from evidence (Reasoning). The teachers were also required to add writing and/or speaking performances to make the student's thinking visible and for the teacher to know if learning has occurred (Communicating). This work is strongly rooted in the *Framework* and the research that led to it's the development. These balanced lessons ensure that students are not only obtaining information, but evaluating and communicating it as well.

South Dakota has further developed this work with lessons to create specific opportunities for student performance in obtaining, evaluating and communicating information. Some example expectations include having students pull meaning from text, produce text to express ideas, engage in discussions about a text or another student's idea, carefully describe observations, ask questions to clarify other students' thinking, and answer questions about their own thinking. Current measures of success include evaluation surveys for participants and facilitators, teacher attendance, and instructional time surveys.

Again, these trainings are about building capacity in the *Framework for K-12 Science Education.* This is the first step in the implementation process. Adding the literacy expectations became a logical access point for the elementary teachers to be able to see the role of science in the classroom. The next step involves the evaluation and adoption of new science standards. While that work is occurring, South Dakota will consult other state's models and also the NSTA Position Statement on the Next Generation Science Standards.

South Dakota has also been implementing reading and writing strategies in the first stage of the CCSS Literacy in Science and Technical Subjects training. This training is broken up into the three "ELA/Literacy shifts" as described by Student Achievement Partners. [5] Below are the shifts with the corresponding strategy targets. Each strategy target also includes multiple tools and techniques for both reading and writing literacy. The goal is to build a good understanding in the shifts of ELA and to allow for some practice in incorporating reading and writing strategies into student performance. The chosen strategy targets are organized by shift for the initial training.



In later SDDOE training sessions and school in-services, the plan is to allow teachers the opportunity to dig into building student learning targets based on Science and CCSS ELA Literacy standards. South Dakota is currently in the process of planning work parallel to the Literacy Design Collaborative to move this agenda forward. [8] Also, the SDDOE is frequently having conversations with Curriculum Directors and other administrators to obtain feedback and to identify needs of districts, but also to help guide them in planning for teacher in-services and curriculum development. State-wide surveys obtain feedback on areas of need to help the SDDOE not only meet the areas of need, but to also be consistent with the Departmental Aspirations. It is South Dakota's goal that all student graduate "College, Career and Life Ready." [4]

References

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