

## Debate about the Importance of “What” We Teach vs “How” We Teach K-12 Science!

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Christine Anne Royce shared her concerns regarding “Engaging in the Art of Teaching with the Next Generation Science Standards (NGSS)” as a *Commentary* for the September 2014 *NSTA Reports*. She asks if it is fair to say that the NGSS focus exclusively on the “What” of science teaching being the content students should know and understand! The “how” science should be taught was included as an emphasis in the *Framework for K-12 Science Education* (NRC, 2012), along with eight teaching practices which were then appended to the NGSS draft.

The NGSS do not deal with the “how” to teach but include the Core Ideas of the Disciplines and identify Crosscutting Concepts. These are all indications of “what” should be taught as K-16 science. But, teacher instruction encompasses the activities of both teachers and students. Royce’s overarching point was that the “how” a teacher selects ways to engage students and to assist them in the explorations of nature should be considered, in addition to the content, concepts, and core ideas that are emphasized in the NGSS.

During the development of the NGSS, I urged the forty-one Achieve members several times, via e-mail, to include needed changes in the “how” teachers teach. This was to no avail! With five attempts to contact Stephen Pruitt to consider this problem, one must wonder if all forty-one Achieve members were aware of all they could do. The eight practices spelled out in the *Framework* are exciting – but --! The Achieve team was also asked by others to look again at the “Less/More” Emphases of reform teaching in the 1996 Standards. The reply was “why mention something that is in place and already working well.” One visitor at an Achieve meeting also asked about the lack of needed changes in typical teaching and why they were not included in the new NGSS. He was told that nothing needed to be done since the old Standards were fine as is.

In recent years, there has been discussion, discourse, and debate about teacher directed instruction versus use of inquiry. And, “inquiry” was noted as a term used with the old National Science Education Standards (NSES) for teaching and omitted with the new Standards – but, the Achieve Team chose not to use it; instead the term “practices” was suggested for use in its place. A focus on concepts and inquiry are on opposite ends of the spectrum for science teaching.

Royce (2014) pointed out that this debate has provided research results on both sides of the topic; some has been published by the National Academies Press as the eight “practices” of teaching that were included in the *Framework*. These practices include: asking questions (for science) and defining problems (for engineering); developing and using models; planning and carrying out investigations; analyzing and interpreting data; using mathematics and computational thinking; constructing explanations (for science) and designing solutions (for engineering);

engaging in argument related to evidence; and obtaining, evaluating, and communicating information (NRC, 2012). Royce (2014) suggests further that current generalized approaches in the educational arena too often blend into the science area and focus on remediation, intervention, and test preparation skills, with little or no direct relationship to how students understand and learn science.

A focus on instruction becomes the question of “how” teachers teach. This becomes personal for each teacher in each classroom each day. Discussions of “how” or what teaching methods to select are at the intersection of general educational understanding, content knowledge, and knowledge of how the students in an individual class will best learn. Royce (2014) contends that teachers need to take the individual components of pedagogical content knowledge and combine them with their own passion and energy for learning and teaching. All of this should encourage students to engage personally in the learning process. She argues that no two classes will be the same, no two ways in teaching follow an exact path, and no two students will arrive at the same outcome at the same moment. Each of these experiences for the students, whole classes, and all teachers will be individual discoveries as noted by the American poet and teacher, Mark Van Doren (n.d.), who stated that “The art of teaching is the art of assisting discovery.” Royce contends that the ultimate answer to the question of “how” teachers teach is a major needed effort.

The NGSS standards are great – with defining “what” K-12 students should learn in science classrooms! But, the eight practices deserve more than merely being appendices to the final NGSS report! We should all hope to have continuing dialog and enlarge more reform views, with input of the forty-one Achieve members!

### References

- National Research Council (NRC). (2012). *Framework for K-12 science education*. Washington DC: The National Academies Press.
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