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Preparing for the New Standards

By now, most readers of this journal know there are new standards for science education coming in 2013. How can we prepare for them before they come out? That's what my colleagues and I asked ourselves last year. Our answer was to read and discuss *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC 2012). Because the standards-writing team is following the *Framework,* we can use the *Framework* as our guide for curriculum and teaching improvements until the standards are released. From our discussions, we began to rethink our teaching practices to address some of the changes the *Framework* recommends.

One such change has been the inclusion of engineering practices in the science classroom. The *Framework* states that participation in science and engineering practices "makes students' knowledge more meaningful and embeds it more deeply into their worldview" (NRC, p. 42). As a former engineer, I was very excited about including engineering in my classroom, but then I realized I had a problem: How do I add engineering practices to a course already full of content? This led to another round of collaboration with colleagues. We identified the core ideas and crosscutting concepts from the *Framework*. We then discussed the idea of removing content from our curriculum that the *Framework* did not deem critical. This was a difficult process because we were passionate about some of the topics being eliminated from our curriculum. But what we had after this process concluded was a very strong and focused curriculum. It had many places throughout the learning progressions where engineering practices could be added. We are currently designing learning activities that require students to apply their knowledge to design and test projects related to their topics of study.

Taking teaching to the next level.

Another change has been the vertical alignment of our core science courses (biology, chemistry, and physics). My science department colleagues and I had discussions about the crosscutting concepts (themes) the *Framework* identifies and how we teach those themes in our classes. One crosscutting concept we looked at was "Energy and matter: flows, cycles, and conservation." In biology, energy is discussed as a part of life processes. In chemistry, energy is discussed as a part of chemical processes. In physics, energy is discussed mostly as a motion or storage process. Since most of our students take biology, then chemistry, and, finally, physics, we're trying to create a common "story of energy" that is continuous throughout the three courses. We want our students to truly understand that biology, chemistry, and physics are all talking about the same concept (energy). Each discipline just discusses different ways that energy is used.

A third change has been in my teaching. I used to provide many lecture notes for my students and assign many homework problems for them to complete. Students completed their homework and asked me questions the next day. The teaching was very teacher focused. The *Framework* suggests a different learning environment. It encourages communication between students and also debate and evidence-based argumentation while problem solving. I've changed my teaching to be more student centered. Now, students work on fewer but more challenging problems together in groups. Since the *Framework* places a strong emphasis on student communication and argumentation, my students now present their evidence-based solutions to the class and engage in a healthy debate about how to correctly solve problems. The result is that my students are now able to solve very complex problems because they've learned how to reason through them.

These changes to my curriculum and teaching have improved student engagement and reasoning ability. My students seem to be scoring higher on their chapter exams and are more confident in their ability to learn science.

For educators just starting to think about how the new science standards will affect their classrooms, I have a few recommendations.

Read A Framework for K–12 Science Education

Read the document and then read it again. It's long but well worth the time. Think about how it relates to your content and how it will impact your classroom. You'll be surprised at how much

flexibility the *Framework* allows to address its recommendations.

Start small

Try making a small change to better align your curriculum and teaching with the *Framework*. Don't tackle a large, schoolwide alignment. Start with your own classroom where you have flexibility. Once you get one change implemented, try another one. After a while, the small changes will add up and resemble the type of education the *Framework* recommends.

Stay in the conversation

There are many conversations happening around the country regarding the new science standards. I've found helpful conversations with my school and district colleagues, professional organizations, e-mail lists, and professional conferences. I've learned more about the intentions of the *Framework* and the new standards through those conversations.

So, listen to people talking about the upcoming standards and contribute your thoughts! You'll become an expert in no time.

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Reference

National Research Council (NRC). 2012. *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.