How Will Our Next Generation of Kids Learn About Science?

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This past summer I had the amazing opportunity to share my experiences in science education with the Military Child Education Coalition. In this article I hope to share some of the key messages from that presentation with the larger military family community. We know kids learn best when they are engaged and can connect new ideas to existing knowledge. The Next Generation Science Standards (NGSS) set the expectations for how all kids should learn and understand science in the 21st century. Schools all over the United States are working hard to implement these new standards in the next few years. This article will provide parents and teachers with a student-centered model of what classrooms might look like in the near future and one example science curriculum that is aligned to NGSS.

NGSS Scientific Practices

One of the most challenging aspects of any science curriculum is integrating the scientific practices that are listed below. Most of us will remember some of these practices as the scientific method we learned in school. It is critical that all kids experience these practices to develop a deep understanding of science as a way of knowing. It will not be easy for teachers to integrate these practices and school districts will need to provide professional development to ensure teachers are prepared for NGSS. Parental support of these practices at home will also promote development of scientific thinking. In the next section, a brief overview of the 5E model will help parents know how their students might experience science in school. The most important idea is that kids should explore before teachers explain to create a more inquiry-based learning environment.

Scientific Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

The Five E's – A Model for Effective Science Teaching

Engagement

The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.

Exploration

Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are

identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.

Explanation

The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.

Elaboration

Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

Evaluation

The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.

Hot Wheels® Speedometry™ encourages inquiry and real-world, problem-based learning through play, hands-on activities and in-depth lesson plans that is mapped to state and national standards including Common Core State Standards (CCSS), Next Generation Science Standards (NGSS) and Texas Essential Knowledge and Skills (TEKS). This education curriculum, co-created with researchers at the University of Southern California Rossier School of Education, combines Hot Wheels® fun, imagination, and action, as well as toys and track to accelerate learning.

Speedometry™ is a free-to-use curriculum targeting fourth grade (8-9 year old) students. Comprised of two units with up to six lessons per unit, Speedometry™ provides coursework intended to cover a period of 10-12 days. Students work in collaborative learning groups to deepen their understanding of speed, angles, slopes, collisions, kinetic energy, and potential energy. The lessons and activities aim to put students on course for success in science and mathematics. A kindergarten curriculum for 5-6 year olds is currently in development and will be released at a later date.

With support from the Mattel Children's Foundation, five faculty members began working with Hot Wheels® designers and (S)cience (T)echnology (E)ngineering (M)ath teachers in April 2013 to develop tools for teaching scientific concepts like velocity, kinetic energy and gravity using the miniature toy cars and modular track already beloved by children. USC Rossier education professors Gale Sinatra, Julie Marsh, Morgan Polikoff, Frederick Freking, and Angela Hasan led the project for a Speedometry™ curriculum for the elementary school students that will help teachers and parents reinforce key STEM concepts. The Speedometry™ curriculum is aligned with the rigorous expectations outlined in the CCSS, NGSS, as well as TEKS, and includes inquiry, play-based, and hands-on activities.

The Rossier team is currently piloting Speedometry™ in schools throughout the greater Los Angeles area, and will evaluate teacher feedback, as well as assess the effects of the curriculum on student knowledge, engagement and motivation to learn. "With the need for more students in the STEM fields, teachers and parents need to find ways to make scientific topics engaging and accessible for students from an early age," said Rossier Dean Karen Symms Gallagher. "The Speedometry curriculum brings science to life for kids while also being grounded by the research and assessment of learning experts in the field of education."

Speedometry for Families

Hot Wheels® Speedometry™ is a fun and engaging way to learn about concepts such as energy, force, and motion. Students also learn scientific and engineering practices such as analyzing and interpreting data. But the fun doesn't have to end when the school bell rings – you can bring Speedometry™ learning home! After all, math and science are all around us.

Continued on page 32...