Science Learning with Design, Engineering and Robotics (Curriculum Exchange)

Mike Ryan, Georgia Institute of Technology
Dr. Marion Usselman, Georgia Institute of Technology

Marion Usselman is a Principal Research Scientist and Associate Director for Federal Outreach and Research at the Georgia Institute of Technology's Center for Education Integrating Science, Mathematics and Computing (CEISMC). She earned her Ph.D. in Biophysics from the Johns Hopkins University and has been with CEISMC since 1996 developing and managing university-K-12 educational partnership programs. She currently leads up a team of educators and educational researchers who are exploring how to integrate science, mathematics and engineering within authentic school contexts and researching the nature of the resultant student learning.

Sabrina Grossman, CEISMC: Georgia Tech
Dr. Jessica D Gale
Beth A. Kostka, Georgia Institute of Technology

Beth Kostka has been with Georgia Institute of Technology's Center for Education Integrating Science, Mathematics and Computing since 2012 and serves as a Research Associate and Curriculum Writer. She originated in Wisconsin and received a B.S. in Biology from Syracuse University and a M.S. in Aquatic Environmental Science from Florida State University with an emphasis in Science Education. Prior to Georgia Tech she worked as a faculty member of the Biology Department and was Director of the elementary school outreach program in the Office of Science Teaching at Florida State University (FSU). In her 21-year career she has worked with National Oceanic and Atmospheric Association and the National Park Service as a science educator and researcher and has been executive director of multiple non-profit environmental organizations. This experience has given Beth a strong background in grant writing, partnership building, laboratory research, teaching across K-12 and adults, as well as program development and curriculum writing.

Miss Nancy Anna Newsome, Georgia Tech - Center for Education Integrating Science, Mathematics, and Computing

Anna Newsome serves as an Educational Outreach Manager at CEISMC for AMP-IT-UP (Advanced Manufacturing & Prototyping Integrated to Unlock Potential) and SLIDER (Science Learning Integrating Design, Engineering, and Robotics). She received a Bachelor of Science in Public Policy from Georgia Tech in 2008. After graduation Anna spent a year working for a private sector event firm before eagerly returning to her alma mater and joining the CEISMC team in January 2010. Anna completed a Master of Science in Educational Research with a concentration in Research, Measurement, and Statistics from Georgia State University in May 2013.

Dr. Brian Douglas Gane, University of Illinois at Chicago
Jayma Koval, Georgia Tech, CEISMC

Jayma Koval is a Teacher in Residence in Georgia Tech's Center for Education Integrating Science, Math and Computing (CEISMC). Previously, Jayma was a middle school science teacher and coordinator of her school's Science Olympiad team.

Mr. Jeffrey H Rosen, Georgia Institute of Technology

Science Learning that Integrates Design, Engineering and Robotics

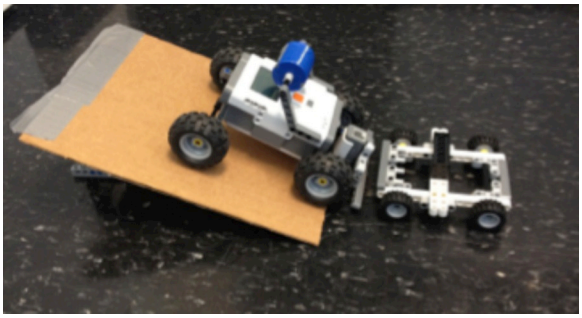
SLIDER®
Science Learning Integrating Design, Engineering, & Robotics

The SLIDER curriculum is an inquiry and project-based learning curriculum that utilizes LEGO Mindstorm ™ NXT kits to teach 8th grade physical science disciplinary content, science and engineering practices, and cross-cutting concepts within regular middle school physical science classrooms. As an integral part of the curriculum, students organize, think about, and design solutions for engineering challenges while they investigate and learn about force, motion and energy. In the process, they actively engage in investigations, data analysis and scientific argumentation.

SLIDER's curriculum design and instructional method grew out of, and is therefore pedagogically similar to, the approach and protocol developed by the *Project- Based Inquiry Science* (PBIS) ™ curriculum, published by It's About Time (Kolodner, et al. 2009). SLIDER has modified and streamlined the PBIS classroom protocols, and specifically incorporates LEGO Mindstorm NXT™ robotics as the instructional manipulative.

The SLIDER curriculum is comprised of two 3-4 week units that together develop standards from all three of the NGSS dimensions. The main science concept focus of Unit 1 is Energy (e.g., transfer of mechanical energy, kinetic and potential energy relationship, law of conservation of energy). Unit 2 focuses on Force and Motion (e.g., force, balance of forces, changes in motion, speed, acceleration, mass and inertia relationship).

The SLIDER curriculum was designed for classrooms where students work in teams of three students, with each team having its own dedicated LEGO NXT robot that the team does not share with any other students. Most of the activities, however, can be accomplished in schools that have a class-set of LEGO NXT kits, defined here as one kit per every three children in the largest class implementing the program. The SLIDER teacher support materials include guidance on managing the LEGO materials.



The materials that will be demonstrated consist of 1) Two comprehensive workbooks that introduce the challenges and guide students through the activities; 2) Student handouts, data collection sheets, etc.; 3) Videos that help frame the challenges; 4) LEGO build instructions for students; 5) Two-page text-based teacher guides; and 6) Assessment rubrics. All materials will be available online at www.slider.gatech.edu

The SLIDER curriculum development and implementation research has been supported by NSF grant #0918618 through the Discovery Learning K-12 program. For more information, contact Marion Usselman at marion.usselman@ceismc.gatech.edu.