Nature-Inspired Design: A PictureSTEM Project Curriculum Module (Curriculum Exchange)

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Tamara J. Moore, Ph.D. is an Associate Professor of Engineering Education at Purdue University. Dr. Moore's research is centered on the integration of STEM concepts in K-12 and higher education mathematics, science, and engineering classrooms in order to help students make connections among the STEM disciplines and achieve deep understanding. Her research agenda focuses on defining STEM integration and investigating its power for student learning. She is creating and testing innovative, interdisciplinary curricular approaches that engage students in developing models of real world problems and their solutions. Her research also involves working with educators to shift their expectations and instructional practice to facilitate effective STEM integration. Tamara is the recipient of a 2012 Presidential Early Career Award for Scientists and Engineers (PECASE) for her work on STEM integration with underrepresented minority and underprivileged urban K-12 students.

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Unit Grade Level: 3-5

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Description of the Project

The PictureSTEM Project is developing an instructional module at each grade level, K-5, which employs engineering and literary contexts to integrate science, technology, and mathematics content instruction in meaningful and significant ways. These transformative new models for STEM learning use picture books and an engineering design challenge to provide students with authentic, contextual activities that engage learners in specific STEM content as well as integrate concepts across traditional disciplinary boundaries. These curricular units go through an extensive design research cycle to ensure a quality product.

Description of the Unit

This 7-day unit is geared towards the upper elementary grades (4-5). It connects learning in the areas of life science, geometry, measurement, data analysis, and engineering design through 7 pairs of literacy and STEM integration activities, each with their own age- and activity-appropriate high-quality trade book. The challenge involves designing a water storage tank for families on Popa Island in Panama.

	Lesson 1 – Biomimicry	**Lesson 2** – Volume	**Lesson 3** – Data Analysis & Volume	**Lesson 4** – What are Adaptations?	**Lesson 5** – Plant Adaptations
Literacy Activities	**Book**: *Nature Got There First: Inventions Inspired by Nature* **Strategy:** Summarize informational text	**Book**: *For Good Measure* **Strategy:** Juicy Words-Vocabulary	**Book**: *Our World of Water: Children and Water Around the World* **Strategy:** Compare & Contrast	**Book:** *What do you do When Something Want to Eat You* **Strategy**: Making Predictions	Student research on biomes and plant adaptations **Strategy**: Research Skills
STEM Activities	Intro to problem: Students explore an example of nature inspired design before sharing products with classmates	Students learn about volume, and how to calculate volume	Students use data analysis and average rainfall data to inform the size and dimensions for their storage tank	Rotate through stations, where students explore the advantages that different adaptations provide	Students research a biome and plant adaptations before sharing findings with the class
	Lesson 6 – Planning your design	**Lesson 7** – Nature-Inspired Design	**Engineering Design Challenge Overview:**		
Literacy Activities	**Book**: *Biomimicry: Inventions Inspired by Nature* **Strategy:** Identifying important details	**Book:** *A Cool Drink of Water* **Strategy**: Author's Message	The 14 Grand Challenges for Engineering, (http://www.engineeringchallenges.org), identify some of the most pressing challenges for the next century. One of these challenges deals with providing all people with access to clean water. During this unit, students will be helping to address this challenge, by designing solutions that help to provide the people of Popa Island, Panama with access to clean and reliable water. Students will also have the chance to experience the field of Biomimicry, and the possibilities for design solutions that come from observing and borrowing ideas from how nature addresses some of the world's problems, like gathering and storing water.		
STEM Activities	Students review before brainstorming & planning for engineering design challenge	Students create prototype, present to the class, and then improve the design			

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