STEM Explore, Discover, Apply – A Middle School Elective (Curriculum Exchange)

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Dr. Krystal Corbett is the Director of Curricula at the Cyber Innovation Center (CIC). She received her B.S. and M.S. in Mechanical Engineering (2008/2010), M.S. in Mathematics (2012), and Ph.D. in Engineering Education (2012) at Louisiana Tech University. Through the CIC, Dr. Corbett manages various educational enterprises. Additionally, she is designing and implementing a three-part middle school elective course, STEM: Explore, Discover, Apply, which fosters excitement in STEM.

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Joshua Coriell is a Curriculum Development Specialist at the Cyber Innovation Center’s National Integrated Cyber Education Research Center. He graduated from Louisiana Tech University in 2011 with a B.S. in Mathematics. A year later he completed his Master of Arts in Teaching at Louisiana Tech University. He is currently working on a high school mathematics curriculum geared toward students interested in STEM fields.
Because the school mascot is the medieval knights, the 7th graders have been asked to build trebuchets to throw prizes into the crowd at pep rallies and sporting events.

Students research three main areas: trebuchets in general, Middle Ages and classes of people, and components of trebuchets (base, supports, lever/fulcrum, counterweight, and sling).

Develop three ideas broken down by the following: base, support, lever/fulcrum, counterweight, and sling.

Assess and rate each design over nine factors in two categories: Components (base, supports, lever/fulcrum, counterweight, and sling) and Assembly (use of materials, ease of construction, function and performance, and uniqueness of design).

Build a prototype for the design chosen in Step 4, and utilize the iterative nature of design.

Create a system based on counterweight mass and the amount the lever is pulled back to hit specified distances. Calculate potential energy for different masses and pull back amounts. Calculate theoretical maximum range for trebuchets. Test various launches of the trebuchet.

Calculate range efficiency, discuss/determine improvements, make improvements, and test the trebuchets again.

**Example Module**

Figure 1 is the engineering design process graphic that guides students through each module. Annotated by each step in the process is a sample of the STEM Discover Catapult module in which students build a trebuchet. Additionally, a creative writing opportunity is included (between Steps 5 and 6); students research heraldry and create a coat of arms and motto to be included on their trebuchets.

**Figure 1: Engineering Design Process**

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**Target Grade Levels**

Explore - 6th grade, Discover - 7th grade, Apply - 8th grade

**Course Implementation**

Schools can implement the STEM EDA curriculum in a variety of ways: as an elective, after school program, or inserted into their existing classes. The current eight modules developed are as follows: Egg Drop (introduces the EDP), Volcanoes, Roller Coasters, Catapults, Genetics, Electricity, Music, and Earthquakes. Additional modules (e.g., Race Cars, Boats, Bridges, Solar Ovens, Bacteria, Immune System, etc.) are being developed to provide schools with multiple module options.