Mount Laurel Township Schools
STEM Curriculum
Harrington

Stage 1: Desired Results	
STEM Unit: Harrington 7th Grade	**Unit:** ROV (Remotely Operated Vehicle): Integrating Ocean Exploration into the Classroom Recruiting the Next Generation of Mechanical, Electrical, and Ocean Engineers
Enduring Understanding(s): • Engineers use scientific knowledge, mathematics, and ingenuity to develop solutions for technical and practical problems. • Engineers design materials, structures, machines and systems while considering the limitations imposed by practicality, safety and cost.	**Essential Questions:** • Why do people work in teams when solving design problems? • Why is the design process so important to follow when creating a solution to a problem? • Why is brainstorming so important when modifying or improving a product? • What is meant by constraints and criteria in the design process?

Students will know…		**Students will be able to…**
The characteristics and scope of technology.	8.2.8.A.1	Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs).
The core concepts of technology.	8.2.8.A.2	Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.
	8.2.8.A.3	Investigate a malfunction in any part of a system and identify its impacts.
The relationships among technologies and the connections between technology and other fields of	8.2.8.A.4	Redesign an existing product that impacts the environment to lessen its impact(s) on the environment.
	8.2.8.A.5	Describe how resources such as material, energy, information, time,

study.		tools, people, and capital contribute to a technological product or system.
The cultural, social, economic and political effects of technology.	8.2.8.B.1	Evaluate the history and impact of sustainability on the development of a designed product or system over time and present results to peers.
The effects of technology on the environment.	8.2.8.B.2	Identify the desired and undesired consequences from the use of a product or system.
	8.2.8.B.3	Research and analyze the ethical issues of a product or system on the environment and report findings for review by peers and /or experts.
The role of society in the development and use of technology.	8.2.8.B.5	Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries and societies.
The attributes of design.	8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
	8.2.8.C.2	Explain the need for optimization in a design process.
	8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
The application of engineering design.	8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
	8.2.8.C.5	Explain the interdependence of a subsystem that operates as part of a system. Create a technical sketch of a product with materials and measurements labeled.
	8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the

The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.		step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
	8.2.8.C.7	Collaborate with peers and experts in the field to research and develop a product using the design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.
	8.2.8.C.8	Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
Apply the design process.	8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
	8.2.8.D.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
	8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
Use and maintain technological products and systems.	8.2.8.D.4	Research and publish the steps for using and maintaining a product or system and incorporate diagrams or images throughout to enhance user comprehension.
Assess the impact of products and systems.	8.2.8.D.5	Explain the impact of resource selection and the production process in the development of a common or technological product or system.
	8.2.8.D.6	Identify and explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment.

MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principals and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Stage 2: Assessment Evidence:

Suggested Performance Task(s): The challenge is to have students work in teams to design and build underwater robots that can complete missions in a pool. The missions simulate real world problems such as collecting specimens from the ocean floor or stopping an oil leak by capping a well at the bottom of the sea. The students must pilot the ROVs in the pool to complete the missions within a specific time frame.	

Stage 3: Learning Plan

Learning Activities: Overview of Course: STEM, Mechanical and Electrical Engineering, and Ocean Exploration • Tools and Tool Safety • ROV Subsystems: Frame	MATE: http://www.marinetech.org/ SeaPerch: http://www.seaperch.org/index MIT SeaPerch: http://seaperch.mit.edu/ NOAA Ocean Exploration: http://oceanexplorer.noaa.gov/okeanos/

Ballast Propulsion (Thrusters) Power (Battery) Control Box Navigation Sensors (camera) Payload (used to perform missions) Tether • Building ROVs Define Problem, Research, Brainstorm, Sketch, Build Frame, Add Payload, Assemble Thrusters, Wire the Control Box • Testing ROV and Redesigning as Needed • Making Connections:	Nautilus Live: http://www.nautiluslive.org/ URI's Inner Space Center: http://innerspacecenter.org/ Woods Hole Oceanographic Institute: http://divediscover.whoi.edu/ • Exploring Careers: http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html http://www.cosee.net/about/careers/

Unit Strategies/Modifications:

Special Education Students:
Development of target vocabulary
Scaffolding comprehension and content-area reading
Decreasing the amount of work presented or required
Using videos, illustrations, pictures, and drawings to explain or clarify graphic organizers
Teaching key aspects of a topic. Eliminating nonessential information
Providing study guides
Allowing students to correct errors (looking for understanding)
Marking students' correct and acceptable work, not the mistakes
Allowing products (projects, timelines, demonstrations, models, drawings, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning

Modifying tests to reflect selected objectives
Using true/false, matching, or fill in the blank tests in lieu of essay tests
Reducing the number of answer choices on a multiple choice test
Allowing the use of note cards or open-book during testing
Utilizing graphic organizers
Providing visuals
Strategic grouping

Gifted Students:
Guided Reading Groups
Literature Circles
Flexible grouping in content areas
Independent projects
Differentiated product assignments
Student Choice
Multiple texts
Multiple intelligence options
Group investigation
Research
Bloom's Taxonomy - Stress higher order thinking skills
Habits of Mind
Webb's Depth of Knowledge – Emphasis on Level 3 and 4

Students at Risk of Failure:
Adjust time for completion of assignments
Allow frequent breaks
Preferential seating
Reduce/minimize distractions
Emphasize teaching (auditory, visual, auditory, tactile)
Individual/small group instruction
Emphasize critical information/key concepts
Pre-teach vocabulary

Provide visual cues
Adjust length of assignment
Break assignments into smaller units
Read directions to student
Positive reinforcement
Frequent checks for understanding
Adapt assessments

English Language Learners:
WIDA Can-Do Descriptors http://www.wida.us/standards/CAN_DOs/
Development of target vocabulary
Scaffolding comprehension, content-area reading
Decreasing the amount of work presented or required;
Using videos, illustrations, pictures, and drawings to explain or clarify.
Graphic organizers
Teaching key aspects of a topic.
Eliminating nonessential information.
Allowing students to correct errors (looking for understanding);
Marking students' correct and acceptable work, not the mistakes;
Showing products (projects, timelines, demonstrations, models, drawings, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
Modifying tests to reflect selected objectives;
Using true/false, matching, or fill in the blank tests in lieu of essay tests;
Reducing the number of answer choices on a multiple choice test;
Allowing the use of note cards or open-book during testing;
Collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student.