Engineering and Energy Transformations

Grade/ Grade Band: 6th	**Topic: Engineering and Energy Transformations**	

Brief Lesson Description: Students will observe energy transformations using the ev3 robot. They will explain how energy is transformed in each program. Then they will design their own program to display an energy transformation.

Performance Expectation(s):

MS-PS3-4. Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample of matter.

Specific Learning Outcomes:
students will be able to

- **identify various forms of energy**
- **explain how energy is transformed while using the 3v3 robot**
- **create and run a program and explain how energy is being transformed in their program**

Narrative / Background Information

Prior Student Knowledge: students will have prior knowledge on the form of energy and how energy is the ability to cause change. They will know about sound energy, thermal energy, light energy, mechanical energy, potential energy, and kinetic energy.

Science & Engineering Practices (SEPs)	Disciplinary Core Ideas (DCIs)	Crosscutting Concepts (CCs)
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scienti c knowledge, principles, and theories. ▪ Apply scienti c ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3) ▪ Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets speci c design criteria and constraints. (MS-PS1-6)	**PS3.B: Conservation of Energy and Energy Transfer** ▪ (NYSED) The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the mass of the sample, and the environment. (MS-PS3-4)	**Energy and Matter** ▪ The transfer of energy can be tracked as energy ows through a designed or natural system. (MS-PS1-6), (MS-PS3-3)

Possible Preconceptions/Misconceptions:
-Students may think that energy is something that always causes movement.
-Energy cannot be quantified.
-various forms of energy can not work together on a system

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

Students will answer the following question " Are you a robot"? Why or why not?
students will write their answers on nearpod and teacher will review and share.
teacher will prompt students to think about how a robot works and how humans work, and focus on students thinking about a code. Teacher will tell students that we are very similar because we both run by a code, humans have a genetic code and robots have a computer code which both allow us to act and do certain things.

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:
Each group of 5 students will receive an ev3 robot and a mac computer. Students will explore the energy transformations that is happening in each robot and explain how energy is involved. After students explore all the programs and robot actions, they will create their own program.

EXPLAIN: Concepts Explained and Vocabulary Defined:

Teacher will prompt students to discuss how the robot uses energy and compare it to how humans use energy.
Vocabulary:
sound energy
light energy
thermal energy
kinetic energy
energy transformation

ELABORATE: Applications and Extensions: Teacher will give students a guide to a simple code for the ev3 robot. Students will then create their own program which will use various forms of energy. students will have access to the lego ev3 link to learn about basic coding.

EVALUATE:

Formative Monitoring (Questioning / Discussion): The handout will serve as a formative assessment, as it has questions at the end which will assess their understanding of the relationship between robots, machines, and energy transformations. Teacher will also assess students based on student responses during turn and talks. I will also conduct a nearpod about an energy transformation and a coding question which will allow me to help students review concepts with energy transformations or coding.

Summative Assessment (Quiz / Project / Report): Students will have an end of unit test on energy, engineering, and heat transfer where they will address forms of energy.

Elaborate Further / Reflect: Enrichment: Teacher will prompt students to think about how robots have been advancing and how thwy are using more energy efficient methods to run the robots.

Materials Required for This Lesson/Activity

Quantity	Description	Potential Supplier (item #)	Estimated Price
6	Lego ev3 robot	LEGO Mindstorm	
6	Laptops with Lego Program installed	NA	
