Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013)

- The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.
- The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Standard

MS-PS3-3: Energy
www.nextgenscience.org/pe/ms-ps3-3-energy

MS-ETS1: Engineering Design
https://www.nextgenscience.org/topic-arrangement/msengineering-design

The selected middle school standards come directly from the NGSS; include a hyperlink to all listed standards. In the case of a manuscript that features the engineering standard (MS-ETS1), please list an appropriate science standard. The EQuiP Rubric stipulates that a science standard should accompany all engineering activities. Note that there may be occasions when this is not possible. EQuiP Rubric: https://www.nextgenscience.org/sites/default/files/EQuIP%20Rubric%20for%20Science%20v2.pdf

Performance Expectation *(PE)*

MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer

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 principles and potential impacts on people and the natural environment that may limit possible solutions.

Identify and list the most appropriate Performance Expectation (PE) that addresses the standards featured in your manuscript. Include the NGSS code.

DIMENSIONS *Examine the SEPs, DCIs, and CCCs associated with the Performance Expectation (PE) by looking for the PE code (in this case, MS-ESS2-2). Identify the SEPs, DCIs, and CCCs that best match what students are doing as described in your manuscript. Note that there may be occasions when the most appropriate SEPs or CCCs are not assigned to the PE.*	**CLASSROOM CONNECTIONS** *This is where you will describe what students are doing that address the SEPs, DCIs, and CCCs.*

Science and Engineering Practice

Analyzing and Interpreting Data Designing Solutions Engaging in Argument from Evidence *The Science and Engineering Practice(s) (SEPs) are taken directly from the SEPs listed at the link(s) provided in the standard box.* *Please limit the number of CCCs to no more than three..*	Students analyze test data from different materials and a control, which are exposed to 20 minutes in the hot box and 20 minutes in the freezer, to decide which materials work best. Students also compare the costs of the materials. Students develop and test different space suit designs using provided materials to optimize heat transfer and cost. Students share their optimized solution and provide evidence to support their selection *For each SEP listed, describe what students are doing that addresses the SEP. This should be clearly described in the manuscript..*

Disciplinary Core Idea *(DCI)*

PS3.B: Conservation of Energy and Energy Transfer • · Energy is spontaneously transferred out of hotter regions or objects and into colder ones. ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. *This information above is taken directly from the Disciplinary Core Idea(s) (DCIs) listed at the link(s) provided in the standard box.* *List the appropriate science DCI and engineering DCI that corresponds to the Pes (in this case, MS-PS3-3 and MS-ETS1-1). Note that there may be times when the activity cannot be aligned to a relevant science DCI*	Students explore heat transfer, as measured by temperature, by insulating the model astronaut. Students develop and test different space suit designs using provided materials to optimize heat transfer and cost. Students answer questions related to the flow of energy as it moves through the astronaut model. *Describe what students are doing that addresses the DCI. This should be clearly described in the manuscript.*

Crosscutting Concept *(CCC)*	
Systems and System Models *The Crosscutting Concept(s) (CCCs) are taken directly from the CCCs listed at the link(s) provided in the standard box.* *Please limit the number of CCCs to no more than three..*	Students use a model astronaut as a system and track the input and output of thermal energy from that system via measurements of temperature. *For each CCC listed, describe what students are doing that addresses the CCCI. This should be clearly described in the manuscript*

Connections to the *Common Core State Standards* (NGAC and CCSSO 2010)

ELA

CCSS.ELA-LITERACY.WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

If appropriate, please list the ELA Common Core Standards that your manuscript incorporates.

Math

CCSS.Math.MP.2: Reason abstractly and quantitatively.

If appropriate, please list the Mathematics Common Core Standards that your manuscript incorporates.

* *Note: A blank table is available for download at http://www.nsta.org/middleschool/msguidelines-scope.aspx*