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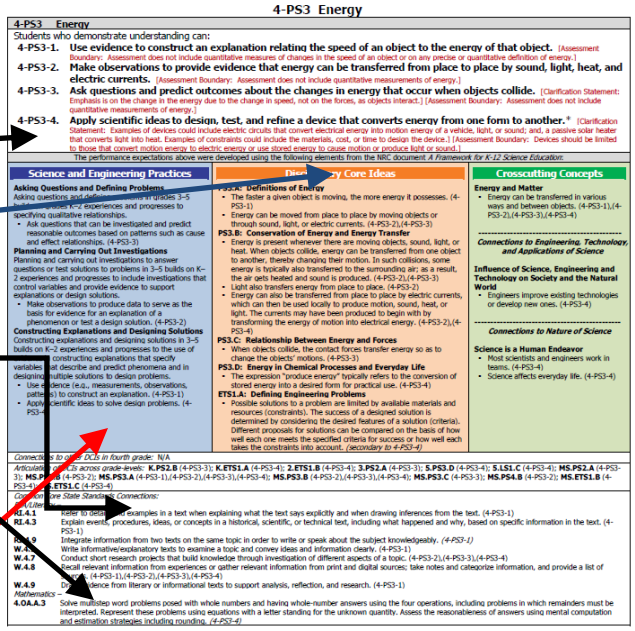
Tip Sheet

Accessing the ELA & CCSSM Connections in the NGSS

SUMMARY

The Next Generation Science Standards (NGSS) cite connections to the national Common Core English/Language Arts (ELA) standards and Common Core State Standards in Mathematics (CCSSM). These connections provide ample opportunities for students to learn reading, writing, and math skills in the course of learning science concepts. Blending science, math, and language together makes learning fun and it better prepares students for the real-world.

HOW TO DO IT?



1. Choose an NGSS grade-specific performance expectation (top of page).
2. Identify the Disciplinary Core Idea (DCI) required to achieve the expectation (middle column).
3. Choose a Common Core ELA standard from the connections box that identifies a task that would enhance or articulate the demonstration of the expectation (bottom of page).
4. Choose a Common Core Math standard from the connections box containing the math required to achieve the expectation.
5. Identify a science or engineering practice (left column) keyed to the expectation. This provides the scenario in which the performance expectation can be demonstrated. (NOTE: RAFT activity kits provide opportunities to teach and use the science and engineering practices in the NGSS and can be also used as tools to demonstrate understanding).

EXAMPLE OF THE PROCEDURE FOR NGSS 4TH GRADE ENERGY

1. **Performance expectation, 4-PS3-1:** Use evidence to construct an explanation relating the speed of an object to the energy of that object.
2. **DCI PS3.A: Definitions of Energy:** The faster a given object is moving, the more energy it possesses.
3. **Common Core Connection, ELA, RI.4.9:** Integrate information from two science texts describing speed and energy in order to write or speak about the subject knowledgeably.
4. **Common Core Connection, Math, 4.OA.A.3:** Solve multi-step problems using whole numbers and equations with a letter variable for the unknown quantity.
5. **Science/Engineering Practice:** Constructing explanations and designing solutions; use evidence (e.g. measurements, observations, or patterns) to construct an explanation.

APPLICATION

The 4th grade performance expectation above refers to an explanation involving non-quantitative descriptions of speed and energy, meaning students are not directly measuring or calculating the two quantities. For example, the students might do an activity where they repeatedly roll a ball down a ramp, increasing its speed each time by pushing it harder down the ramp and then observing how far it pushes a wooden block from the end of the ramp. They are not measuring the speed but can identify a pattern between the ball's relative speed and the movement of the block, measured in centimeters.

To incorporate the **ELA standard**, the teacher can provide two texts that have simple grade-level-appropriate descriptions, diagrams, and examples of energy transfer between objects. The students will integrate the texts and be able to describe the movement of the block in terms of energy transferred from the ball to the block. This description can be combined with the pattern already identified between the ball's speed and the block's movement to describe the pattern in terms of the ball's energy, thus providing students with enough information to understand that the faster a given object is moving, the more energy it possesses (DCI).

The connected **math standard** can be addressed if students are introduced to the kinetic energy equation $KE = ½ mv^2$ conceptually, understanding that v^2 is actually v x v, that is, the variable v times itself (explained in terms of multiples, not exponents). This can aid students in articulating their explanation of why the ball had more energy with each stronger push (resulting in increased relative speed), which they observed as the block being pushed further from the ramp.

ASSESSMENT

When designing activities that incorporate the science and engineering practices in the Next Generation Science Standards it is important to note the assessment boundaries listed for each performance expectation. For example, in the expectation discussed above the assessment boundary says, "Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy", meaning that in the example above the students will not make measuring the speed of the ball part of their explanation.

RELATED RESOURCES

Some RAFT hands-on activities that can easily be used to teach the NGSS Science & Engineering Practices for grades K-12:

Car on a Roll -	http://www.raft.net/ideas/Car on a Roll.pdf
Colors of Light –	http://www.raft.net/ideas/Colors of Light.pdf
Critter Capsule	http://www.raft.net/ideas/Critter Capsule.pdf
Puff Rockets –	http://www.raft.net/ideas/Puff Rocket.pdf

OTHER RESOURCES

Next Generation Science Standards –
http://www.nextgenscience.org/next-generation-science-standards

Common Core Standards ELA/Literacy -
http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

Common Core State Standards in Math -
http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf