C2 Collaborative's DECONSTRUCTION OF STANDARDS for CLASSROOM IMPACT Guide

for use with

*NEXT GENERATION SCIENCE STANDARDS**

Your Time-Saving Curriculum-Building Resource

Middle School

Sampler

C2 Collaborative, Inc.
Supporting Today's Educators, Shaping Tomorrow's Leaders

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ISBN-978-1-940668-63-5

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Deconstruction of Standards for Classroom Impact Guide for use with *Next Generation Science Standards**

C2 Collaborative, Inc. is pleased to offer this grade-level tool for all educators to utilize as they move from the knowledge of the *Next Generation Science Standards** to application of these standards in the classroom.

C2 Collaborative's Deconstruction of Standards for Classroom Impact Guide for use with Next Generation Science Standards* is an instructional tool intended to help educators develop curriculum, lessons, unit plans, assessments, and tasks to support effective science teaching and learning. This practical, content-rich resource is not intended only for those who have adopted the *Next Generation Science Standards**; indeed it can be used as a resource for how to move from standard language to standard practice in science. The standard deconstruction is a process by which the learning expectations are unpacked into more manageable pieces that can then be taught in a manner that builds conceptual understanding and task complexity while considering prior knowledge.

We hope that this resource will be of value as a teaching and learning tool and to facilitate discussion with your colleagues as you work toward preparing students to be global citizens capable of solving complex and challenging problems, so many of which will be rooted in science.

Overview

*C2 Collaborative's Deconstruction of Standards for Classroom Impact Guide for use with Next Generation Science Standards** are organized around each grade level and/or discipline as indicated in the table below.

BOOKS FOR ELEMENTARY GRADES (COVERS ALL DCIs)	
Kindergarten	Grade 3
Grade 1	Grade 4
Grade 2	Grade 5
BOOKS FOR MIDDLE SCHOOL (GRADES 6-8)	**BOOKS FOR HIGH SCHOOL (GRADES 9-12)**
Physical Sciences	Physical Sciences
Life Sciences	Life Sciences
Earth and Space Sciences	Earth and Space Sciences
Engineering, Technology, and Application of Sciences	Engineering, Technology, and Application of Sciences

Understanding the Organization
Grades kindergarten to fifth are composed of sections based on the disciplinary core ideas (DCI) of Physical Science, Life Science, Earth and Space Science, and Engineering, Technology, and Applications of Science. Grades sixth to eighth and ninth to twelfth are grouped as grade bands and each book is dedicated to one of the disciplinary core ideas.

Middle and High School: Sixth to Eighth and Ninth to Twelfth Grade Bands
Each book represents a single disciplinary core idea (e.g., Physical Science, Life Science, Earth and Space Science, or Engineering, Technology, and Applications of Science) that is organized in grade bands for middle school (grades 6–8) or high school (grades 9–12). The title page contains a disciplinary component idea (e.g., MS-PS1 Matter and Its Interactions) that represents science expectations for students in grades sixth through eighth or ninth through twelfth. Next there is a two-page spread that should be viewed together as the information on both pages is connected.

The pages on the left include the following sections: **Understanding the Performance Expectation, Planning Instruction,** and **Instructional Leadership**.

Understanding the Performance Expectation:
The **Performance Expectation** (PE) and **Clarification Statement** are taken directly from the NGSS document (see Appendix). The **Big Idea** provides educators with an overall context for learning the component idea while the **Critical Vocabulary** (both academic and discipline specific) is aligned to the **Performance Expectation**.

Planning Instruction:
Materials & Equipment, Instructional Strategies, and a suggested **Graphic Organizer** have been identified as they relate to the PE. These examples can be used during instruction or as a model to adapt based on the needs of your students.

Instructional Leadership:
Teachers, coaches, principals, and other administrators can use the "Look For" as an indicator of learning when visiting classes. This indicator can also help teachers select a work product to monitor student learning.

The pages on the right include the following sections: **Understanding the Instructional Targets** and **Learning Targets**.

Understanding the Instructional Targets:
The **Essential Question(s)** sparks thinking and promotes student and teacher engagement with the concepts. Knowing the **Depth of Knowledge Level** of the **Performance Expectation** will help in the development of appropriately aligned tasks for the student. A sample **Highest Level Assessment Item** is provided as a model that can be adapted or adopted. The **Assessment Boundary** is taken directly from the *Next Generation Science Standards** document (see Appendix) and it specifies the limits of assessments, in particular large scale assessments.

Learning Targets:
In the **Students Should Be Able To** section, the Performance Expectation is deconstructed into three progressive learning targets of Know, Think, and Do, and specific Examples are provided for each learning target where appropriate. This will help educators see how conceptual knowledge builds based on the outcomes of the Performance Expectation.

ENERGY

MS-PS3

DECONSTRUCTION OF STANDARDS
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UNDERSTANDING THE PERFORMANCE EXPECTATION

PERFORMANCE EXPECTATION	**MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
BIG IDEA	Energy can be transferred from one object or system to another.
CRITICAL VOCABULARY	kinetic, energy, work, joules, potential, conservation
CLARIFICATION STATEMENT	Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a Wiffle ball versus a tennis ball.

PLANNING INSTRUCTION

INSTRUCTIONAL STRATEGIES	**DIRECT INSTRUCTION** Explain that kinetic energy is the energy of motion.
MATERIALS & EQUIPMENT	graph paper, science notebook
GRAPHIC ORGANIZER	graph, cause and effect chart

INSTRUCTIONAL LEADERSHIP

"LOOK FOR"	students analyzing data, cooperative learning

MS-PS3

UNDERSTANDING THE INSTRUCTIONAL TARGETS

PERFORMANCE EXPECTATION	**MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.		
ESSENTIAL QUESTION(S)	• What is the relationship between kinetic energy of an object, its mass, and its speed?		
DEPTH OF KNOWLEDGE	**Level**		**Highest Level Assessment Item**
	2	Skills & Concepts	Explain the relationships between kinetic energy and mass as depicted in their graphs. For example, students compare graphic results of rolling a baseball vs. rolling a ping pong ball down a ramp. Explain the relationships between kinetic energy and speed as depicted in the graphs (e.g., compare graphic results of kinetic energy and speed such as riding a skateboard at different speeds).
ASSESSMENT BOUNDARY	n/a		

LEARNING TARGETS

	Know	Think	Do
STUDENTS SHOULD BE ABLE TO:	Define kinetic energy. Describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	Make a graph of data that describes the relationship of kinetic energy to mass and kinetic energy to speed. Interpret a graph of data that describes the relationship of kinetic energy to mass and kinetic energy to speed.	n/a
EXAMPLES	Observe and discuss what happens when balls of different sizes and weights are rolled across the classroom floor.	Time the speed in which balls with different masses are rolled down a ramp. Graph the data. Describe the relationship between the mass of the ball and the amount of time it took to reach the bottom of the ramp.	n/a

BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4

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BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

UNDERSTANDING THE PERFORMANCE EXPECTATION	
PERFORMANCE EXPECTATION	**MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
BIG IDEA	Similarities among organisms are found in anatomical features and patterns of development and can be used to infer the degree of relatedness among organisms.
CRITICAL VOCABULARY	fossil, chronological order
CLARIFICATION STATEMENT	Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.

PLANNING INSTRUCTION	
INSTRUCTIONAL STRATEGIES	**DIRECT INSTRUCTION** Identify progression patterns by comparing and contrasting fossil pictures and drawing connections between the photographs.
MATERIALS & EQUIPMENT	pictures of anatomical structures in organisms, pictures of fossil layers
GRAPHIC ORGANIZER	T-Chart to compare and contrast

INSTRUCTIONAL LEADERSHIP	
"LOOK FOR"	notes, diagrams, and data charts in science notebook

MS-LS4

UNDERSTANDING THE INSTRUCTIONAL TARGETS

PERFORMANCE EXPECTATION	**MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.		
ESSENTIAL QUESTION(S)	• What evidence supports the theory of evolution?		
DEPTH OF KNOWLEDGE	**Level**		**Highest Level Assessment Item**
	3	Strategic Thinking & Reasoning	Draw conclusions about the origins of modern day animals by looking at pictures of fossils of extinct animals such as the giant sloth.
ASSESSMENT BOUNDARY	Assessment does not include the names of individual species or geological eras in the fossil record.		

LEARNING TARGETS

	Know	Think	Do
STUDENTS SHOULD BE ABLE TO:	List extinctions and changes of life forms from sources.	Explain how patterns in the fossil record provide evidence of evolution; use examples.	Study and explain data showing the chronological order of fossil appearance in rock layers to demonstrate the existence, diversity, changes of life forms, and extinction throughout the history of life on Earth.
EXAMPLES	Name three characteristics of fossils.	Explain why model fossils are not real fossils.	Make a model of a fossil using homemade salt dough.

EARTH AND HUMAN ACTIVITY

MS-ESS3

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UNDERSTANDING THE PERFORMANCE EXPECTATION

PERFORMANCE EXPECTATION	**MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
BIG IDEA	The distribution of Earth's natural resources is a result of past and current geologic processes and human activity.
CRITICAL VOCABULARY	latitude, longitude, earthquake, shape memory alloys, shock absorbers
CLARIFICATION STATEMENT	Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).

PLANNING INSTRUCTION

INSTRUCTIONAL STRATEGIES	**DIRECT INSTRUCTION** Demonstrate how to plot earthquake locations on a map of the world using latitude and longitude data to identify areas prone to earthquakes.
MATERIALS & EQUIPMENT	maps of the world with latitude and longitude, Internet access, "building materials" such as marshmallows, gelatin, pasta, glue, craft sticks
GRAPHIC ORGANIZER	T-Chart that compares and contrasts building strategies for earthquake zones and non-earthquake zones

INSTRUCTIONAL LEADERSHIP

"LOOK FOR"	notes, diagrams, and data charts in science notebook

MS-ESS3

UNDERSTANDING THE INSTRUCTIONAL TARGETS			
PERFORMANCE EXPECTATION	**MS-ESS3-2**		
	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.		
ESSENTIAL QUESTION(S)	• How can we use the data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects?		
DEPTH OF KNOWLEDGE	**Level**		**Highest Level Assessment Item**
	3	Strategic Thinking & Reasoning	Compare building technologies used in earthquake zones with those used in non- earthquake zones.
ASSESSMENT BOUNDARY	n/a		

LEARNING TARGETS			
STUDENTS SHOULD BE ABLE TO:	**Know**	**Think**	**Do**
	Describe how data on natural hazards is used to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	Brainstorm possible technologies to mitigate the effects of natural hazards. Discriminate between the different types of natural hazards and the limitations of technology in mitigating their effects.	Analyze natural hazards/ catastrophic events and identify the technologies used to mitigate their effects.
EXAMPLES	Know that there are certain areas on Earth that are prone to earthquakes.	Brainstorm and research technologies that can be used to make buildings "earthquake proof."	Build a model of a structure that can withstand an earthquake.

ENGINEERING DESIGN

MS-ETS1

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ENGINEERING DESIGN

UNDERSTANDING THE PERFORMANCE EXPECTATION

PERFORMANCE EXPECTATION	**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.
BIG IDEA	Models can be used to test design solutions.
CRITICAL VOCABULARY	variable, buoyancy
CLARIFICATION STATEMENT	n/a

PLANNING INSTRUCTION

INSTRUCTIONAL STRATEGIES	**HANDS-ON ACTIVITY** Students determine the best shape of a boat for carrying heavy cargo. They test their boat shapes several times using different variables to provide evidence to support which shape is the best.
MATERIALS & EQUIPMENT	clay, water, pennies, basin
GRAPHIC ORGANIZER	sketches and designs

INSTRUCTIONAL LEADERSHIP

"LOOK FOR"	notes, diagrams, and data charts in science notebook

MS-ETS1

UNDERSTANDING THE INSTRUCTIONAL TARGETS

PERFORMANCE EXPECTATION	**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.		
ESSENTIAL QUESTION(S)	• Why is it important to analyze data from tests?		
DEPTH OF KNOWLEDGE	**Level**		**Highest Level Assessment Item**
	4	Extended Thinking	Create a fair test in order to determine the best shape of a boat to carry heavy cargo.
ASSESSMENT BOUNDARY	n/a		

LEARNING TARGETS

	Know	**Think**	**Do**
STUDENTS SHOULD BE ABLE TO:	Recognize that parts of different solutions can sometimes be combined to create a solution that is better than any of the previous individual designs.	n/a	Analyze data from a variety of tests to determine similarities and differences among several designs and then identify the characteristics of those designs that can be combined to provide a better solution.
EXAMPLES	Explain how to organize materials and investigations in order to improve a model or prototype.	n/a	Research how an object used to meet the needs and wants of humans has developed and changed over time. Summarize how the changes have improved that object.