

NORTH DAKOTA SCIENCE CONTENT STANDARDS

Draft – April 2014 – Draft

Performance Expectations by Grade: Grades 3-5 Engineering Design

Released for Public Comment



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North Dakota Science Content Standards, Draft: April 2014, Released for Public Comment is based on the Next Generation Science Standards.¹

¹ NGSS Lead States. 2013. **Next Generation Science Standards: For States, By States**. Washington, DC: The National Academies Press.

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North Dakota Science Content Standards

Performance Expectations by Grade

This document, released for public review, presents the North Dakota Science Content Standards in tables, which include individual Performance Expectations. Refer to the North Dakota *Introduction* for more information related to the layout of the document. A separate document presents the North Dakota Science Content Standards arranged in tables, which include groups of Performance Expectations arranged by Disciplinary Core Idea. Readers are invited to review both documents and provide feedback regarding preference for organizational format in the associated questionnaire.

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**Performance Expectations by Grade: Grades 3-5
Engineering Design**

3-5-ETS1-1 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</p> <ul style="list-style-type: none"> Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. 	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. 	<p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> People's needs and wants change over time, as do their demands for new and improved technologies.

Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems include:

Fourth Grade:4-PS3-4

Articulation of DCIs across grade-levels:

K-2.ETS1.A ; MS.ETS1.A ; MS.ETS1.B

Common Core State Standards Connections:

ELA/Literacy -

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1)

Mathematics -

MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1)

MP.4 Model with mathematics. (3-5-ETS1-1)

MP.5 Use appropriate tools strategically. (3-5-ETS1-1)

3-5.OA Operations and Algebraic Thinking (3-ETS1-1)

3-5-ETS1-2 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p style="text-align: center;">Science and Engineering Practices</p> <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. 	<p style="text-align: center;">Disciplinary Core Ideas</p> <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. 	<p style="text-align: center;">Crosscutting Concepts</p> <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
<p><i>Connections to 3-5-ETS1.B: Developing Possible Solutions Problems include:</i></p>		
<p>Fourth Grade:4-ESS3-2</p>		
<p><i>Articulation of DCIs across grade-levels:</i></p>		
<p>K-2.ETS1.A ; K-2.ETS1.B ; K-2.ETS1.C ; MS.ETS1.B ; MS.ETS1.C</p>		
<p><i>Common Core State Standards Connections:</i></p>		
<p><i>ELA/Literacy -</i></p>		
<p>RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. <i>(3-5-ETS1-2)</i></p>		
<p>RI.5.1 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. <i>(3-5-ETS1-2)</i></p>		
<p>RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. <i>(3-5-ETS1-2)</i></p>		
<p><i>Mathematics -</i></p>		
<p>MP.2 Reason abstractly and quantitatively. <i>(3-5-ETS1-2)</i></p>		
<p>MP.4 Model with mathematics. <i>(3-5-ETS1-2)</i></p>		
<p>MP.5 Use appropriate tools strategically. <i>(3-5-ETS1-2)</i></p>		
<p>3-5.OA Operations and Algebraic Thinking <i>(3-ETS1-2)</i></p>		

3-5-ETS1-3 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p style="text-align: center;">Science and Engineering Practices</p> <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. 	<p style="text-align: center;">Disciplinary Core Ideas</p> <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. 	<p style="text-align: center;">Crosscutting Concepts</p>
<p><i>Connections to 3-5-ETS1.B: Developing Possible Solutions Problems include:</i></p> <p>Fourth Grade:4-ESS3-2</p>		
<p><i>Connections to K-2-ETS1.C: Optimizing the Design Solution include:</i></p> <p>Fourth Grade:4-PS4-3</p>		
<p><i>Articulation of DCIs across grade-levels:</i></p> <p>K-2.ETS1.A ; K-2.ETS1.C ; MS.ETS1.B ; MS.ETS1.C</p>		
<p><i>Common Core State Standards Connections:</i></p>		
<p><i>ELA/Literacy -</i></p>		
<p>W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-3)</p>		
<p>W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-3)</p>		
<p>W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-3)</p>		
<p><i>Mathematics -</i></p>		
<p>MP.2 Reason abstractly and quantitatively. (3-5-ETS1-3)</p>		
<p>MP.4 Model with mathematics. (3-5-ETS1-3)</p>		
<p>MP.5 Use appropriate tools strategically. (3-5-ETS1-3)</p>		