Proficiency Scales for “Work and Think Scientifically”

Explore Phenomena or Design Problems, Make Observations & Collect Data Through Investigations (ELE1)

- 3-5 Grade Band

Make Sense of Patterns & Relationships in Observations & Data Through Representation, Analysis & Interpretation (ELE2)

- 3-5 Grade Band

Construct Models & Causal Explanations of Phenomenon or Design Solutions to Problems Using Evidence & Reasoning (ELE3)

- 3-5 Grade Band

Revise Ideas, Models, Explanations, & Design Solutions Through Critique & Argumentation (ELE4)

- 3-5 Grade Band

Score 4.0 Exceeds the Standard (E)
Score 3.0 Mastery of Grade-Level Standard (M)
Score 2.0 Progressing Toward Grade-Level Standard (P)
Score 1.0 Initial Progress Toward Grade-Level Standard (IP)
Score 0.0 Even with Help, No Success (NP)
Not Evaluated (NE)

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FUTURE WITHOUT BOUNDARIES℠

Proficiency Scales for "Work and Think Scientifically"

Students explore phenomena or design problems, make observations, and collect data through investigations.
(Essential Learning Event #1)

Students have an initial experience with a phenomenon or a design problem and have the opportunity to share their wonderings and ask questions about observations. Questions to be answered or design problems to be solved are identified. Students further observe, explore, and study the phenomena or design problem through investigation.

Grades 3-5

Score 4.0	The student uses and demonstrates understanding of the essential learning event above the grade level band expectation.
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 performance
Score 3.0	The student uses and demonstrates an understanding of the essential learning event described in Score 2.0 in conjunction with the Disciplinary Core Ideas of NGSS to explain phenomena and solve problems. The grade level Performance Expectations or other equivalent three-dimensional learning goals may be used to demonstrate mastery at this score level.
Score 2.5	In addition to score 2.0 performance, partial success at score 3.0 performance
Score 2.0	The student demonstrates understanding of the essential learning event. The example student actions below include knowledge, skills, and strategies that students will need to achieve grade level mastery of the Performance Expectations of NGSS or equivalent three-dimensional learning goals. Students at this score level are not using all dimensions of NGSS to explain phenomena and solve problems.

Asking Questions and Defining Problems (SEP1)	**Planning and Carrying Out Investigations (SEP 3)**
Initial Ideas and Questions about a Phenomenon ❏ Students make observations of a phenomenon. ❏ Students ask questions based on observations of a phenomenon. ❏ Students share initial ideas, perspectives, and previous experiences about a phenomenon. ❏ Students represent a phenomenon through drawings, words, or sketches. Identify Questions that can be Investigated ❏ Students ask and/or identify questions that can be answered by an investigation. ❏ Students ask questions about what would happen if a variable is changed. [3-5] ❏ Students identify scientific (testable) and non-scientific (non-testable) questions. [3-5] ❏ Students predict reasonable outcomes based on patterns such as cause and effect relationships. [3-5] Defining Problems for Engineering ❏ Students define simple problems that can be solved through the development of a new or improved object or tool.	Planning and Carrying Out Investigations (SEP3) Plan an Investigation ❏ Students (with guidance) plan and conduct an investigation in collaboration with peers. ❏ Students plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. ❏ Students 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. [3-5] Carry Out an Investigation and Record Data/Observations ❏ Students evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question. ❏ Students make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. ❏ Students evaluate appropriate methods and/or tools for collecting data. [3-5] ❏ Students make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal. ❏ Students make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. [3-5]

	❏ Students 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. [3-5] ❏ Students 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. [3-5] ❏ Students make predictions based on prior experiences. ❏ Students make predictions about what would happen if a variable changes. [3-5] ❏ Students test two different models of the same proposed object, tool, or process to determine which meets criteria for success. [3-5]
Score 1.5	In addition to score 1.0 performance, partial success at score 2.0 performance
Score 1.0	With help, students demonstrate partial success at Score 2.0 content and Score 3.0 content.
Score 0.5	With help, partial success at score 1.0 performance
Score 0.0	Even with help, no success of Score 2.0 and Score 3.0 content.

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Proficiency Scales for "Work and Think Scientifically"

Students make sense of patterns and relationships in observations and data through representation, analysis, and interpretation. (Essential Learning Event #2)	
Students make sense of observations or collected data and determine how to represent the data. The presentation of data helps reveal patterns and relationships and allows results to be communicated with others. Student analysis of data helps bring out its meaning and relevance so that it may be used as evidence for the phenomenon or design problem. Interpretation of data helps students identify significant features and patterns, use mathematics to represent relationships between variables, and take into account sources of error.	
Grades 3-5	
Score 4.0	The student uses and demonstrates understanding of the essential learning event above the grade level band expectation.
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 performance
Score 3.0	The student uses and demonstrates an understanding of the essential learning event described in Score 2.0 in conjunction with the Disciplinary Core Ideas of NGSS to explain phenomena and solve problems. The grade level Performance Expectations or other equivalent three-dimensional learning goals may be used to demonstrate mastery at this score level.
Score 2.5	In addition to score 2.0 performance, partial success at score 3.0 performance
Score 2.0	The student demonstrates understanding of the essential learning event. The example student actions below include knowledge, skills, and strategies that students will need to achieve grade level mastery of the Performance Expectations of NGSS or equivalent three-dimensional learning goals. Students at this score level are not using all dimensions of NGSS to explain phenomena and solve problems.

Analyzing and Interpreting Data (SEP4)	**Using Mathematics and Computational Thinking (SEP5)**
❏ Students record information (observations, thoughts, and ideas). ❏ Students use and share pictures, drawings, and/or writings of observations. ❏ Students use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.	❏ Students decide when to use qualitative vs. quantitative data. ❏ Students decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. [3-5] ❏ Students use counting and numbers to identify and describe patterns in the natural and designed world(s).

	❏ Students compare predictions (based on prior experiences) to what occurred (observable events). ❏ Students represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. [3-5] ❏ Students analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/ or computation. [3-5] ❏ Students compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. [3-5] ❏ Students analyze data from tests of an object or tool to determine if it works as intended. ❏ Students analyze data to refine a problem statement or the design of a proposed object, tool, or process. [3-5] ❏ Students use data to evaluate and refine design solutions. [3-5] ❏ Students organize simple data sets to reveal patterns that suggest relationships. [3-5] ❏ Students describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. ❏ Students describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems. [3-5] ❏ Students use quantitative data to compare two alternative solutions to a problem. ❏ Students create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem. [3-5]
Score 1.5	In addition to score 1.0 performance, partial success at score 2.0 performance
Score 1.0	With help, students demonstrate partial success at Score 2.0 content and Score 3.0 content.
Score 0.5	With help, partial success at score 1.0 performance
Score 0.0	Even with help, no success of Score 2.0 and Score 3.0 content.

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Proficiency Scales for "Work and Think Scientifically"

Students construct models and causal explanations of phenomenon using evidence and reasoning. (Essential Learning Event #3)	
Once students have gathered evidence through observation and investigation, students develop models and construct initial explanations. They capitalize on various texts, media, and discussions to obtain scientific ideas and concepts to help explain the phenomenon, as well as discover additional evidence that might be used in their own evidence-based explanation. In engineering, students undertake a design project to construct and/or implement a solution that meets specified design criteria and constraints.	
Grades 3-5	
Score 4.0	The student uses and demonstrates understanding of the essential learning event above the grade level band expectation.
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 performance
Score 3.0	The student uses and demonstrates an understanding of the essential learning event described in Score 2.0 in conjunction with the Disciplinary Core Ideas of NGSS to explain phenomena and solve problems. The grade level Performance Expectations or other equivalent three-dimensional learning goals may be used to demonstrate mastery at this score level.
Score 2.5	In addition to score 2.0 performance, partial success at score 3.0 performance
Score 2.0	The student demonstrates understanding of the essential learning event. The example student actions below include knowledge, skills, and strategies that students will need to achieve grade level mastery of the Performance Expectations of NGSS or equivalent three-dimensional learning goals. Students at this score level are not using all dimensions of NGSS to explain phenomena and solve problems.

<table>
<tr><td></td><td>
<table>
<tr><th>Develop and Use a Model (SEP2)</th><th>Construct an Explanation (SEP6)</th><th>Obtain and Evaluate Information (SEP8)</th></tr>
<tr>
<td>❏ Students distinguish between a model and the actual object, process, and/or events the model represents.
❏ Students compare models to identify common features and differences.
❏ Students identify limitations of models. [3-5]
❏ Students develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
❏ Students collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. [3-5]
❏ Students develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. [3-5]
❏ Students develop and/or use models to describe and/or predict phenomena. [3-5]
❏ Students develop a simple model based on evidence to represent a proposed object or tool.
❏ Students develop a diagram or simple physical prototype to convey a proposed object, tool, or process. [3-5]
❏ Students use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. [3-5]</td>
<td>❏ Students use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.
❏ Students construct an explanation of observed relationships (e.g., the distribution of plants in the backyard). [3-5]
❏ Students use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. [3-5]
❏ Students identify the evidence that supports particular points in an explanation. [3-5]
❏ Students use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
❏ Students generate and/or compare multiple solutions to a problem.
❏ Students apply scientific ideas to solve design problems. [3-5]
❏ Students generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. [3-5]</td>
<td>❏ Students read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).
❏ Students read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence. [3-5]
❏ Students compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices. [3-5]
❏ Students describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.
❏ Students combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices. [3-5]
❏ Students obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.
❏ Students obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. [3-5]
❏ Students communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.
❏ Students communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. [3-5]</td>
</tr>
</table>
</td></tr>
<tr><td>Score 1.5</td><td>In addition to score 1.0 performance, partial success at score 2.0 performance</td></tr>
</table>

Score 1.0	With help, students demonstrate partial success at Score 2.0 content and Score 3.0 content.
Score 0.5	With help, partial success at score 1.0 performance
Score 0.0	Even with help, no success of Score 2.0 and Score 3.0 content.

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Proficiency Scales for "Work and Think Scientifically"

Students revise ideas, models, explanations, and design solutions through critique and argumentation.
(Essential Learning Event #4)

As students share models and explanations or solutions, they use argumentation and critique with peers to refine and revise their thinking. Such discussions may lead to further investigations or design iterations. Models and explanations about phenomena or solutions to problems are improved and refined as additional ideas and evidence is provided.

Grades 3-5

Score 4.0	The student uses and demonstrates understanding of the essential learning event above the grade level band expectation.
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 performance
Score 3.0	The student uses and demonstrates an understanding of the essential learning event described in Score 2.0 in conjunction with the Disciplinary Core Ideas of NGSS to explain phenomena and solve problems. The grade level Performance Expectations or other equivalent three-dimensional learning goals may be used to demonstrate mastery at this score level.
Score 2.5	In addition to score 2.0 performance, partial success at score 3.0 performance
Score 2.0	The student demonstrates understanding of the essential learning event. The example student actions below include knowledge, skills, and strategies that students will need to achieve grade level mastery of the Performance Expectations of NGSS or equivalent three-dimensional learning goals. Students at this score level are not using all dimensions of NGSS to explain phenomena and solve problems.

Revise and Refine a Model (SEP2)	Revise an Explanation (SEP6)	Argue from Evidence (SEP8)
❏ Students revise and refine a model based on new data, evidence, or information. ❏ Students modify a model, based on evidence, to match what happens when a variable or component of a system is changed. (SEP3) ❏ Students discuss the benefits and drawbacks of a model or different models (that they have created or that was created by others). ❏ Students apply a model to a related example and then revise the model to reflect new information. ❏ Students evaluate a model by comparing predictions to the real world and then adjust the model accordingly. (SEP3) ❏ Students design a test of a model to ascertain its reliability. (SEP3)	❏ Students construct a revised or expanded explanation based on new evidence or context. ❏ Students give feedback to each other about written explanations. (SEP7) ❏ Students identify gaps or weaknesses in explanatory accounts (their own or those of others). (SEP7) ❏ Students ask questions about other students' explanations. (SEP1) ❏ Students apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. ❏ Students apply scientific ideas or principles to refine a solution to a complex real-world problem, based on scientific knowledge,	❏ Students identify arguments that are supported by evidence. ❏ Students distinguish between explanations that account for all gathered evidence and those that do not. ❏ Students analyze why some evidence is relevant to a scientific question and some is not. ❏ Students distinguish between opinions and evidence in one's own explanations. ❏ Students compare and refine arguments based on an evaluation of the evidence presented. [3-5] ❏ Students distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. [3-5]

		student-generated sources of evidence, prioritized criteria, and trade-off considerations. ❏ Students revise and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. ❏ Students optimize performance by revising design through prioritizing criteria, making tradeoffs, testing, revising, and retesting.	❏ Students listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument. ❏ Students respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions. [3-5] ❏ Students construct an argument with evidence to support a claim. ❏ Students construct and/or support an argument with evidence, data, and/or a model. [3-5] ❏ Students use data to evaluate claims about cause and effect. [3-5] ❏ Students make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence. ❏ Students make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. [3-5]
Score 1.5	In addition to score 1.0 performance, partial success at score 2.0 performance		
Score 1.0	With help, students demonstrate partial success at Score 2.0 content and Score 3.0 content.		
Score 0.5	With help, partial success at score 1.0 performance		
Score 0.0	Even with help, no success of Score 2.0 and Score 3.0 content.		

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