SC DEPARTMENT OF EDUCATION

Office of Assessment and Standards

Skill Progressions for the Science and Engineering Practices

The purpose of the Skill Progressions for the Science and Engineering Practices are to provide tools for teachers to make learning more transparent and to help find the right entry points for students in their progress towards mastering each science and engineering practice skill. These progressions were designed to be student facing using kid-friendly language. We know that these skills are embedded throughout the SC Science Standards and want to empower students and teachers to be able to make informed decisions about their learning. These progressions can be used as a tool for: self-assessment, conferencing feedback, goal setting, small group lesson planning, reflection, peer feedback, and more.

We used the K–12 Conceptual Vertical Articulation of the Science and Engineering Practices and Profile of the SC Graduate Competencies as guideposts to design the four levels of the progression. Levels 1-4 show a continuum of growth in each science and engineering practice skill. Level 1 is aligned to the K-2 grade band, Level 2 is aligned to the 3-5 grade band, Level 3 is aligned to the 6-8 grade band, and Level 4 is aligned to the 9-12 grade band. We know that not all of our students perform exactly on grade level; and therefore, students and teachers can use these progressions to find the right entry point for each student's learning. The color coding represents the growth of a given skill across the levels. (NOTE: The colors in one progression do not correlate to the colors in another progression.)

Please complete the following feedback survey to give us your insight on the use of this tool. Your feedback will be used to make additions and changes to these existing samples. Reach out to your Personalized Learning Team regional coach if you have any questions or need further support.

1. **Asking Questions & Defining Problems:** Scientists ask and refine questions about phenomena that lead to explanations of how the natural and designed world(s) works. Engineers ask questions to define the problems, identify constraints, and determine criteria for an effective solution.

	Level 1	Level 2	Level 3	Level 4
Asking Questions	I can ask questions based on my observations of what is around me.	I can ask scientific questions that cannot be answered with a yes or no. I can ask questions about what would happen if one thing (variable) were changed.	I can ask a **testable question** that I could answer by doing an investigation. I can ask questions that help uncover the relationship between the independent and dependent variables. I can ask questions that challenge the logic of an argument, interpretation of a data set, or a design.	I can ask testable questions based on diverse sources (observations, models, articles, etc.) that address enduring problems or issues in the field. I can ask questions to determine how multiple variables impact the outcome of the investigation. I can evaluate the questions of others to analyze the clarity, relevance, depth, and potential impact.
Defining Problems	With help, I can notice and describe something around me that isn't working well and could be improved. With help, I can gather and record information to help me understand the problem.	I can name a design problem that can be solved by creating or changing an object, tool, or process. I can gather and record information to help me understand the problem.	I can explain a design problem that can be solved by creating or changing an object, tool, or process and why it has significance in my community. I can gather and record information to help me understand the problem and the constraints.	I can reframe a design problem that can be solved by creating or changing an object, tool, or process that may include social, technical, and/or environmental considerations. I can gather, record, and analyze information to help me understand the problem and its context, and to articulate key design constraints.

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies were used to create this progression: **Investigate Through Inquiry** and **Designing Solutions**.

2. Developing & Using Models: Scientists construct and use models to help develop and understand explanations about natural phenomena. Engineers use models as helpful tools to test proposed systems and to recognize strengths and limitations of new designs.

	Level 1	Level 2	Level 3	Level 4
Developing & Using Models	I can compare models to find common features and differences. With help, I can explain how a model represents something in the world. With help, I can develop a model that represents something (ex. relationships, patterns, living/non-living things) in the world.	I can explain how a model represents something in the world. I can identify the limitations of a model. I can develop a model that represents a scientific principle, object, tool, or process. I can develop and use a model to: • show cause and effect relationships in the world. • describe and/or make predictions.	I can evaluate the strengths of a model and explain the limitations. I can develop or modify a model to: • generate data • test ideas • to describe unobservable mechanisms. • show relationships among variables, including those that are not observable.	I can evaluate the quality, including limitations, of two different models of the same proposed object, tool, or system in order to find the one that best fits the criteria. I can develop, or modify a model to illustrate relationships between: • systems • components of systems • I can develop a model to: • generate data to support explanation • analyze systems • solve problems • test a proposed system or process I can move flexibly between model types based on quality and limitations.

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies were used to create this progression: **Designing Solutions** and **Lead Teams**.

3. Planning & Carrying Out Investigations: Scientists use observations and data collected to test existing theories and explanations or to revise and develop new ones. Engineers use investigations to gain data to specify design criteria and to test their designs.

	Level 1	Level 2	Level 3	Level 4
Planning & Carrying Out Investigations	I can discuss different ways to observe/measure data to answer a question. With help, I can plan and do an investigation to help me gather data to answer my question. I can make predictions based on what I already know.	I can plan and carry out an investigation that changes one variable and produces data that we can use as evidence. When given options, I can identify the best tools that will help me gather the data I need. I can make a prediction about what happens if a variable is changed.	During an investigation, I can: • identify independent and dependent variables. • identify the best available tools and methods for collection. • determine how much data I need to collect to explain why something happens. • collect data as evidence to help answer questions or test design solutions under a range of conditions. I can formulate a claim about what will happen when a variable is changed. I can analyze my data and revise the experimental design to produce more accurate and precise data.	During an investigation, I can: • describe how the variables in the investigation interact and manipulate the variables as needed • modify the best available tools/methods as needed for data collection and recording. • determine the quantity and precision of data required to draw the most accurate conclusion. I can formulate a claim that accurately describes relationships between dependent and independent variables. I can evaluate the limitations of data precision and refine my design to produce more accurate and precise data.

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competency was used to create this progression: **Investigate Through Inquiry**.

*The skills involved in planning and carrying out investigations can be done independently or collaboratively.

4. Analyzing & Interpreting Data: Scientists use a range of tools to identify the significant features and patterns in data. Engineers use a range of tools and analyze data collected in the tests of their designs and investigations.

	Level 1	Level 2	Level 3	Level 4
Organizing & Representing Data	With help, I can organize my data into tables or graphs.	I can organize my data to represent relationships using graphical displays (ex. maps, charts, graphs, tables).	I can organize and represent various data sets using graphical displays, relevant digital tools, and basic mathematical analysis (mean, median, mode, variability, etc.).	I can organize and represent various data sets (ex. archival) using graphical displays, relevant digital tools, and mathematical analysis (slope, intercept, and correlation coefficient for linear fit, etc.)
Analyzing & Interpreting Data	With help, I can describe the patterns I see in the data. I can use patterns to answer a question or solve a problem. With help, I can explain the data. I can use data from an investigation to make comparisons. I can use data to decide if something works the way it is supposed to.	I can describe the patterns and relationships I see in the data. I can use reasoning and contextual information to explain the data. I can look for similarities and differences in the data. I can use data to improve a tool or design solution.	I can describe patterns, relationships, and outliers in various data sets, and explain what they mean in the context of my investigation. I can identify linear and nonlinear relationships in graphical displays of various data sets. I can make inferences about the data and explain phenomena using reasoning, math skills, and contextual information. I can use data to find the range in which my object, tool, or system works best. I can evaluate limitations of data (measurement error, etc.).	I can describe important relationships among variables/factors in one or more sources of data using a range of tools or strategies. I can draw evidence-based inferences about the data to support a claim. I can evaluate limitations of data, tools, or systems. I can use data to improve ideas based on the success criteria for a proposed system or process.

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies were used to create this progression: **Investigate Through Inquiry** and **Reason Quantitatively**.
*The expectation at the 2, 3, & 4 star level is that students use metric units (ex. Celsius, meters, milliliters).
*Data literacy provides cross-curricular opportunities to support math standards

5. Using Mathematical and Computational Thinking: Scientists use mathematics and computation as tools for representing physical variables and their relationships. Engineers use mathematical and computational representations of established relationships and principles as an integral part of design.

	Level 1	Level 2	Level 3	Level 4
Using Mathematical & Computational Thinking	I can use counting and numbers to describe the patterns I see. With help, I can use data to compare solutions. With help, I can decide when to use numbers or words to describe data. With help, I can measure (ex. length, height, etc.) and compare different objects. With help, I can use a strategy to come up with a mathematical representation.	I can describe the patterns in a simple data set to show relationships. I can use and/or create graphs/charts to compare solutions. I can decide when it is best to use data in the form of numbers or words (qualitative and quantitative). When addressing problems and questions, I can: • estimate and/or measure (ex. area, volume, weight, time) • graph number data I can choose and apply at least one problem-solving strategy to come up with a mathematical representation.	I can use digital tools to analyze large data sets for patterns and trends. I can use mathematical representations (graphs, charts, etc.) to explain the data sets and how they support a conclusion When addressing problems and questions, I can: • apply calculations (ratio, rate, percent, simple algebra, etc.) • create a series of ordered steps (algorithm)	I can create a claim that uses algebraic thinking and analysis (a range of linear and nonlinear functions, exponentials and logarithms, and computational tools for statistical analysis, etc.) When addressing complex measurement problems and questions, I can: • apply unit conversions • use algebra and functions

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies was used to create this progression:
Use Sources and **Reason Quantitatively**.
*The expectation at the 2, 3, & 4 star level is that students use metric units (ex. Celsius, meters, milliliters).
*Data literacy provides cross-curricular opportunities to support math standards

6. Constructing Explanations and Designing Solutions: Scientists construct logically coherent explanations of phenomena that are consistent with the available evidence. Engineers' designs are based on scientific knowledge and models of the material world.

	Level 1	Level 2	Level 3	Level 4
Constructing Explanations	I can use my five senses to gather information about an object or something that happened. With help, I can use what I see and notice to help explain things better.	I can observe, measure, and look for patterns to use as evidence. I can organize data/information I've collected (patterns, observations, outliers, measurements, etc.) and use it as evidence to explain things. I can identify evidence that supports specific points in an explanation.	I can construct or refute an explanation using: • sufficient and appropriate evidence from valid and reliable sources (including my own investigations). • both quantitative and qualitative relationships between variables • Models and representations I can discuss the limits of the evidence I've used to support the claim. I can describe how the evidence supports or refutes the explanation.	I can construct or refute an explanation using: • sufficient and appropriate evidence from a variety of valid and reliable sources (models, theories, simulations, peer review). • scientific ideas, principles, and/or evidence, taking into account unexpected effects. I can use scientific reasoning, theories, and/or models to: • link evidence to the claims • evaluate how well the data support the explanation
Designing Solutions	With help, I can make a list of ideas to fix a problem. With help, I can look at different ways to solve a problem. With help, I can build something (prototype) that helps solve a problem. With help, I can test our prototype to see how it works.	I can create more than one solution to a problem and compare them to see which one best meets the design criteria and constraints. I can select and use the best materials or tools for developing the prototype. I can use scientific ideas to build one prototype that solves a problem. I can test my prototype and make one or more improvements, based on what I learned during testing, and record results.	I can engage in a design cycle to build a prototype (object, tool, process) that meets specific criteria and constraints. I can optimize my design's performance by: • Prioritizing criteria • Making tradeoffs • Revising my design • Re-testing	I can design, or refine a solution to a complex, real-life problem using: • Scientific knowledge • My own sources of evidence • Prioritized criteria • Tradeoff considerations I can optimize my design's performance by: • testing or study different variables that impact the design • considering unexpected effects

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies were used to create this progression: **Investigate Through Inquiry** and **Designing Solutions**.

*Refer to page 7 of the Standards document for the Engineering Design Process.

7. Engaging in Argument from Evidence: Scientists identify the strengths and weaknesses of a line of reasoning to engage in argument for finding the best explanation of a natural phenomenon. Engineers engage in argument from evidence to find the best possible solution to a problem.

	Level 1	Level 2	Level 3	Level 4
Engaging in Argument	I can tell the difference between opinions and facts. I can make a claim and support it with evidence. With help, I can put my ideas in order.	I can tell the difference between facts, logical conclusions, and opinions. I can develop or evaluate a claim and support it using relevant evidence (data, a model, etc.). I can organize my ideas and evidence to support my argument and purpose.	I can develop or evaluate an argument using empirical evidence and reasoning while: • Addressing diverse scientific perspectives. • Supporting, or refuting an explanation or model	I can develop, defend, or evaluate an argument using empirical evidence and reasoning by: • Developing a claim that is supported by scientific knowledge and my own evidence (data). • Showcasing the competing perspectives including the tradeoffs, limitations, and constraints. • Seeking additional information to consider multiple perspectives to better understand challenging ideas, conclusions, and contradictions
Giving and Receiving Feedback	I can respectfully listen to another person's claim in order to: • understand their argument. • agree or disagree and explain why With help, I can improve my argument.	While respectfully listening to another person's claim, I can: • pose a question • respond in a way that provides helpful feedback • agree or disagree using evidence I can use feedback (teacher or peers) to identify areas for improvement in my argument.	I can reflect on how the reasons or evidence provided by others inform or change the way I am thinking. I can use feedback and self-assess against criteria to identify areas for improvement in my argument.	I can use feedback and self-assess against criteria to strengthen my argument for my intended purpose.

*Both the K-12 Conceptual Vertical Articulation of SEP's document and the following PSCG Competencies were used to create this progression: **Express Ideas** and **Use Sources**.

8. Obtaining, Evaluating, and Communicating Information: Scientists derive meaning from texts and evaluate the validity of information to then communicate ideas. Engineers derive meaning from other's work and texts and evaluate the information, to apply it usefully to express their ideas.

	Level 1	Level 2	Level 3	Level 4
Obtaining & Evaluating Information	With help, I can get information from texts, text features, or media to answer a question or support a claim. With help, I can use reading strategies (question, synthesize, infer, determine importance, etc.) to determine patterns in the natural world. With help, I can question who the author/creator is and why the source was created. I can identify if the science we read or watch is real or make believe.	I can get information from a text, text feature (subheadings, graphs, tables, charts, diagrams, etc.) or media to answer a question or support a claim. I can use critical reading strategies (question, synthesize, infer, determine importance, etc.) to determine central ideas and patterns in the natural world. I can ask questions about the source (*Who created it? Why was it created?)* and evaluate the accuracy of the source (look for supporting evidence, look at other sources, check for bias, etc.) to determine if it's reliable.	I can get information from multiple scientific texts, text features (subheadings, graphs, tables, charts, diagrams, etc.) or media to answer a question or support a claim. I can use critical reading strategies while engaging with grade appropriate sources to help me make meaning, self-monitor, and achieve my purpose (identify bias through questioning, developing central ideas for an argument, etc.). I can gather important information about the source(s) to evaluate their currency, relevance, authority, accuracy, and purpose (CRAAP test) and determine their reliability and usefulness for my particular purpose. I can evaluate data, hypotheses, and/or conclusions in texts considering competing information.	I can obtain information by critically reading scientific literature to compare and synthesize information. I can use criteria, search methods, and tools to identify relevant and credible sources reflecting multiple points of view, for my particular purpose. I can assess the credibility of sources to determine their reliability and usefulness for my particular purpose and note important gaps or limitations.
Communicating Information	I can summarize what the source (text, video, etc.) is about. With help, I can share information (talking, writing, drawing, building, etc.) with others.	I can use key details to summarize what the source is about. With my audience in mind, I can share the information gathered and explain how it connects to the natural world.	I can integrate qualitative and quantitative information to my summary to clarify claims and findings. Knowing my audience's perspectives, I can synthesize key ideas and make connections from multiple sources (data, models, student investigations, etc.) to communicate information.	I can cite the most relevant and important evidence to summarize the source and explain the central idea. I can communicate information through scientific arguments, explanations, or solutions that attend to diverse perspectives and counterclaims.

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