# A Crosswalk Between the OAS-S Science and Engineering Practices and the ACT Science Skills

The Oklahoma Academic Standards for Science (OAS-S) specify what students should know and be able to do at the end of each grade level or science course. They consist of three main components, also known as the 3-dimensions:

- **Science and Engineering Practices (SEP):** the skills students should be using to investigate science ideas
- **Disciplinary Core Ideas (DCI):** the science ideas (content) students should be learning through investigations
- **Crosscutting Concepts (CCC):** the thinking skills students should be using to investigate science ideas

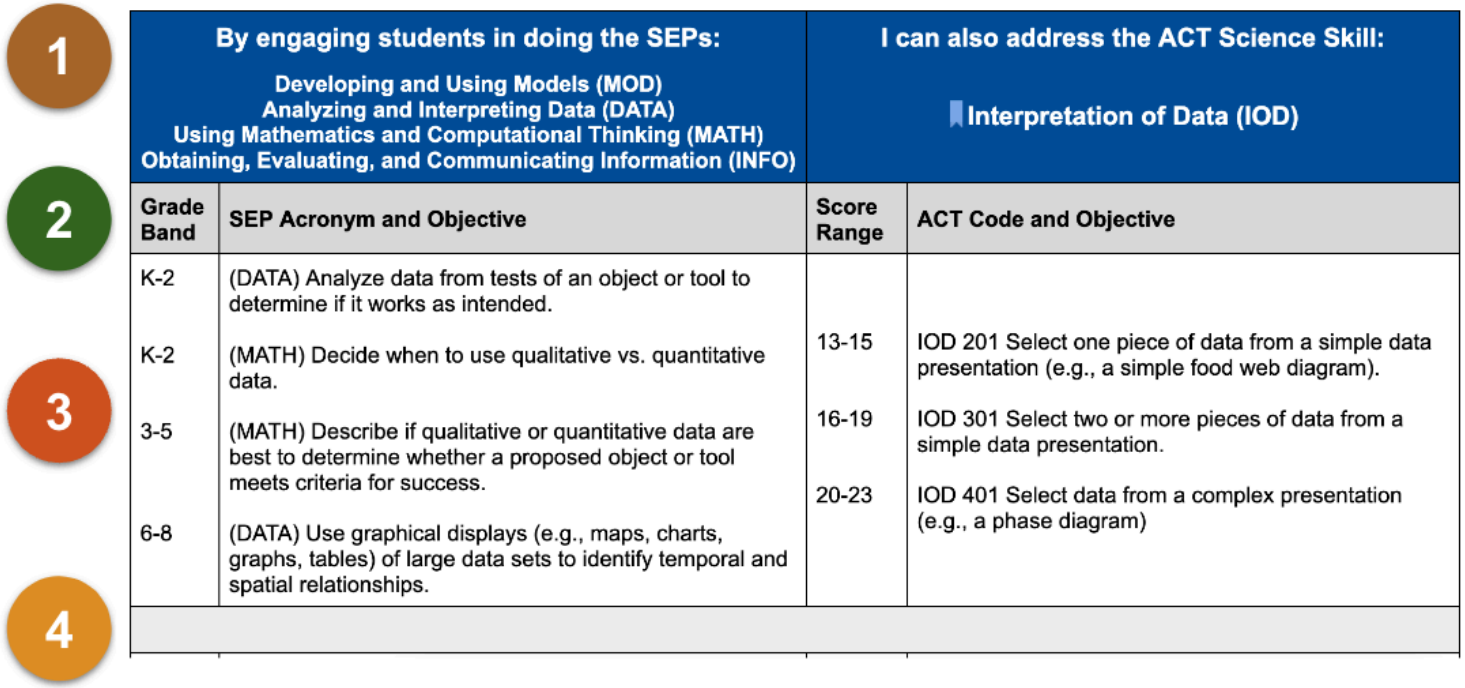
This document provides a crosswalk to identify the similarities between the science and engineering practices (SEP) dimension of the OAS-S and the ACT Science Standards. **This is not a complete list of SEP objectives from the OAS-S.** Only the SEP objectives that are similar to the ACT science skills are included. The following table is an overview of the similarities between the skill categories.

| OAS-S Science & Engineering Practices | ACT Science Skills |
|---|---|
| **1.** Asking Questions and Defining Problems (Q&P) | Scientific Investigations (SIN) |
| **2.** Developing and Using Models (MOD) | Interpretation of Data (IOD)<br>Evaluation of Models, Inferences, and Experimental Results (EMI) |
| **3.** Planning and Carrying Out Investigations (INV) | Scientific Investigations (SIN) |
| **4**. Analyzing and Interpreting Data (DATA) | Interpretation of Data (IOD)<br>Scientific Investigations (SIN) |
| **5.** Using Mathematics and Computational Thinking (MATH) | Interpretation of Data (IOD)<br>Scientific Investigations (SIN) |
| **6.** Constructing Explanations and Designing Solutions (E&P) | Evaluation of Models, Inferences, and Experimental Results (EMI) |
| **7.** Engaging in Scientific Argument from Evidence (ARG) | Evaluation of Models, Inferences, and Experimental Results (EMI) |
| **8.** Obtaining, Evaluating, and Communicating Information (INFO) | Interpretation of Data (IOD)<br>Evaluation of Models, Inferences, and Experimental Results (EMI) |

*Click here for a printable version of this table.

## How to Read The Crosswalks

There are three total crosswalks. Each crosswalk is multiple pages with several bundles of skills. The example below highlights the structure of one skill bundle.




| By engaging students in doing the SEPs:<br>Developing and Using Models (MOD)<br>Analyzing and Interpreting Data (DATA)<br>Using Mathematics and Computational Thinking (MATH)<br>Obtaining, Evaluating, and Communicating Information (INFO) | | I can also address the ACT Science Skill:<br>Interpretation of Data (IOD) | |
|---|---|---|---|
| **Grade Band** | **SEP Acronym and Objective** | **Score Range** | **ACT Code and Objective** |
| K-2 | (DATA) Analyze data from tests of an object or tool to determine if it works as intended. | 13-15 | IOD 201 Select one piece of data from a simple data presentation (e.g., a simple food web diagram). |
| K-2 | (MATH) Decide when to use qualitative vs. quantitative data. | 16-19 | IOD 301 Select two or more pieces of data from a simple data presentation. |
| 3-5 | (MATH) Describe if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. | 20-23 | IOD 401 Select data from a complex presentation (e.g., a phase diagram) |
| 6-8 | (DATA) Use graphical displays (e.g., maps, charts, graphs, tables) of large data sets to identify temporal and spatial relationships. | | |

**Section 1** identifies which science and engineering practices have been bundled (grouped) with one ACT science skill. In this example, four SEPs have been identified as having similar objectives to the one ACT science skill.

**Section 2** identifies the details for each objective. For the SEPs, the information includes the grade band indicating the general timeline for when students are expected to learn and demonstrate each practice, the acronym representing the specific SEP, and the objective itself. To identify the specific grade level or subject area for when a student begins doing that SEP objective, please reference the science standards. For the ACT, details consist of the score range indicating a student's proficiency level for each objective, accompanied by the ACT code corresponding to it and the objective description.

**Section 3** lists the different SEP objectives (left column) that are similar to a bundle of ACT objectives (right column). The SEP objectives may come from various practices and are identified by an acronym. All ACT objectives come from the same science skill. **This section is not a line-by-line comparison of skills, nor is this a complete list of all SEPs required by the OAS-S.** This crosswalk only includes SEP objectives that are similar to ACT skills. All ACT science skills are included.

**Section 4** indicates a bundle of objectives has ended and a new one has begun. SEP and ACT objectives are only listed once per table, and each bundled section may or may not include all grade bands and/or score ranges as certain skills are not developmentally appropriate for lower or upper ranges.

## How to Use This Resource

Teams of educators (e.g., administrators, curriculum coordinators, instructional coaches, teachers) can use this resource to identify how the science and engineering practices of the OAS-S support students with developing the science skills assessed on the ACT. This information can assist with designing instructional units and lessons that integrate specific ACT science skills when students are engaging in related science and engineering practices. Educators may also find the Science Vertical Learning Progressions and/or the Oklahoma Academic Standards for Science helpful when determining the specific grade level and/or subject area associated with the different SEP objectives listed in this crosswalk.

Remember the goal for science and engineering education is for students to figure out the causes of phenomena and develop solutions to problems. This crosswalk only highlights one of three dimensions required by the OAS-S. To ensure students receive deep, meaningful learning experiences, educators need to engage students in doing *all* SEP objectives while integrating the other two dimensions from the OAS-S. Science and engineering practices should not be taught separately from science ideas as this can lead to a fragmented understanding of the subject. Integration encourages critical thinking and better prepares students for the complexity of scientific and engineering work they may encounter later in their academic and/or professional lives.

**Quick Links:** Interpretation of Data  Scientific Investigations  Evaluation of Models, Inferences, and Experimental Results

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| By engaging students in doing the SEPs:<br>Developing and Using Models (MOD)<br>Analyzing and Interpreting Data (DATA)<br>Using Mathematics and Computational Thinking (MATH)<br>Obtaining, Evaluating, and Communicating Information (INFO) | | I can also address the ACT Science Skill:<br>Interpretation of Data (IOD) | |
|---|---|---|---|
| **Grade Band** | **SEP Acronym and Objective** | **Score Range** | **ACT Code and Objective** |
| K-2 | (DATA) Analyze data from tests of an object or tool to determine if it works as intended. | | |
| K-2 | (MATH) Decide when to use qualitative vs. quantitative data. | 13-15 | IOD 201 Select one piece of data from a simple data presentation (e.g., a simple food web diagram). |
| 3-5 | (MATH) Describe if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. | 16-19 | IOD 301 Select two or more pieces of data from a simple data presentation. |
| 6-8 | (DATA) Use graphical displays (e.g., maps, charts, graphs, tables) of large data sets to identify temporal and spatial relationships. | 20-23 | IOD 401 Select data from a complex presentation (e.g., a phase diagram) |
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| K-2 | (MATH) Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. | 20-23 | IOD 402 Compare or combine data from a simple data presentation (e.g., order or sum data from a table) |
| K-2 | (MOD) Compare models to identify common features and differences. | 24-27 | IOD 502 Compare or combine data from a complex data presentation. |
| 3-5 | (DATA) Compare and contrast data collected by different groups in order to discuss similarities and differences in | 24-27 | IOD 501 Compare or combine data from two or more simple data presentations (e.g., categorize data from |

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| | their findings. | | a table using a scale from another table). |
| 9-12 | (DATA) Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations. | 28-32 | IOD 601 Compare or combine data from a simple data presentation with data from a complex data presentation. |
| | | 33-36 | IOD 701 Compare or combine data from two or more complex data presentations. |
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| K-2 | (DATA) Record information (thoughts, observations, and ideas). | | |
| K-2 | (MATH) Use counting and numbers to identify and describe patterns in the natural and designed world. | | |
| K-2 | (MOD) Develop and/or use models to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed worlds. | | |
| 3-5 | (MATH) Organize simple data sets to reveal patterns that suggest relationships. | 13-15 | IOD 202 Identify basic features of a table, graph, or diagram (e.g., units of measurement). |
| 3-5 | (MATH) Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific questions and engineering problems. | 20-23 | IOD 403 Translate information into a table, graph or diagram. |
| 3-5 | (DATA) Represent data in tables and/or various graphical displays (bar, graphs, pictographs, pie charts) to reveal patterns that indicate relationships. | | |
| 3-5 | (MOD) Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. | | |

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| 6-8<br><br>6-8<br><br>9-12 | (DATA) Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.<br><br>(MOD) Develop and/or use a model to predict and/or describe unobservable mechanisms.<br><br>(MATH) Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. | | |
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| 3-5<br><br>3-8<br><br>6-8<br><br>6-8<br><br>6-8<br><br>6-8 | (DATA) Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.<br><br>(DATA) Analyze and interpret data to provide evidence for phenomena.<br><br>(MATH) Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.<br><br>(DATA) Analyze and interpret data to determine similarities and differences in findings.<br><br>(DATA) Analyze data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success.<br><br>(INFO) Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts. | 24-27<br><br>33-36 | IOD 505 Analyze presented information when given new, simple information.<br><br>IOD 702 Analyze presented information when given new, complex information. |

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| 9-12<br><br>9-12 | (DATA) Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.<br><br>(INFO) Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. | | |
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| 6-8<br><br>6-8<br><br>6-8<br><br>6-8<br><br>9-12<br><br>9-12 | (MOD) Develop or modify a model based on evidence to match what happens if a variable or component of a system is changed.<br><br>(MOD) Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.<br><br>(MATH) Use mathematical representations to describe and/or support scientific conclusions and design solutions.<br><br>(DATA) Analyze concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible.<br><br>(MOD) Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components in a system.<br><br>(MATH) Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or | 16-19<br><br>20-23<br><br>24-27<br><br>24-27<br><br>28-32<br><br>28-32 | IOD 304 Determine how the values of variables change as the value of another variable changes in a simple data presentation.<br><br>IOD 404 Perform a simple interpolation or simple extrapolation using data in a table or graph.<br><br>IOD 503 Determine how the values of variables change as the value of another variable changes in a complex data presentation.<br><br>IOD 504 Determine and/or use a simple (e.g., linear) mathematical relationship that exists between data.<br><br>IOD 603 Perform a complex interpolation or complex extrapolation using data in a table or graph.<br><br>IOD 602 Determine and/or use a complex (e.g., nonlinear) mathematical relationship that exists between data. |

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| | explanations. | | |
| 9-12 | (DATA) Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. | | |
| 9-12 | (DATA) Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient to linear fits) to scientific and engineering questions and problems, using digital tools when feasible. | | |
| 9-12 | (DATA) Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. | | |
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| PK-12 | The OAS-S suggest students learn scientific terminology *while* doing science. The focus should be on terms that are needed to understand the how and why behind the causes of phenomena, and not on memorizing definitions for a general list of scientific terminology. | 16-19 | IOD 302 Understand basic scientific terminology |
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| K-2 | (INFO) 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 worlds. | 13-15 | IOD 203 Find basic information in text that describes a simple experiment. |
| K-2 | (INFO) Obtain information using various texts, text features, and other media that will be useful in answering scientific questions and/or support a scientific claim. | 16-19 | IOD 303 Find basic information in text that describes a complex data presentation. |

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| 3-5 | (INFO) 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 | (INFO) 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 | (INFO) 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 | (INFO) Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. | | |
| 6-8 | (INFO) Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed worlds. | | |
| 9-12 | (INFO) Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler yet accurate terms. | | |

| By engaging students in doing the SEPs:<br>Analyzing and Interpreting Data (DATA)<br>Planning and Carrying Out Investigations (INV)<br>Asking Questions and Defining Problems (Q&P)<br>Using Mathematics and Computational Thinking (MATH) | | I can also address the ACT Science Skill:<br>Scientific Investigations (SIN) | |
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| **Grade Band** | **SEP Objective** | **Score Range** | **Code and ACT Science Skill** |
| K-2 | (INV) With guidance, plan and conduct an investigation in collaboration with peers. | | |
| 3-5 | (INV) 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 is considered. | 13-15 | SIN 201 Find basic information in text that describes a simple experiment. |
| | | 16-19 | SIN 303 Find basic information in text that describes a complex experiment. |
| 3-5 | (INV) Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success. | 20-23 | SIN 401 Understand a simple experimental design. |
| | | 20-23 | SIN 403 Identify a control in an experiment. |
| 3-5 | (Q&P) Asking questions about what would happen if a variable is changed. | 20-23 | SIN 404 Identify similarities and differences between experiments. |
| 3-5 | (DATA) Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. | 24-27 | SIN 501 Understand a complex experimental design. |
| | | 28-32 | SIN 601 Determine the hypothesis for an experiment. |
| 6-8 | (Q&P) Ask questions to determine relationships between independent and dependent variables and relationships in models. | 33-36 | SIN 701 Understand precision and accuracy issues. |
| 6-8 | (DATA) Analyze and interpret data to determine | | |

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| | similarities and differences in findings. | | |
| 6-8 | (DATA) Consider limitations of data analysis (e.g., measurement error, sample selection) and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). | | |
| 9-12 | (INV) Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. | | |
| 9-12 | (INV) Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements, and consider limitations on the precision of the data and refine the design accordingly. | | |
| 9-12 | (Q&P) Ask questions to determine relationships, including quantitative, between independent and dependent variables. | | |
| 9-12 | (DATA) Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations. | | |
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| K-2 | (INV) Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question. | 13-15 | SIN 202 Understand the tools and functions of tools used in a simple experiment. |

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| K-2 | (MATH) Decide when to use qualitative vs. quantitative data. | 16-19 | SIN 302 Understand the tools and functions of tools used in a complex experiment. |
| 3-5 | (INV) Evaluate appropriate methods and/or tools for collecting data. | 16-19 | SIN 301 Understand the methods used in a simple experiment. |
| 3-5 | (Q&P) 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. | 20-23 | SIN 402 Understand the methods used in a complex experiment. |
| 3-5 | (MATH) Describe if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. | 20-23 | SIN 405 Determine which experiments utilized a given tool, method, or aspect of design. |
| 6-8 | (INV) Evaluate the accuracy of various methods for collecting data. | | |
| 6-8 | (INV) Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. | | |
| 6-8 | (Q&P) Define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. | | |
| 9-12 | (INV) Select appropriate tools to collect, record, analyze, and evaluate data. | | |

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| 9-12 | (INV) Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. | | |
| 9-12 | (A&P) Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations. | | |
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| K-2 | (INV) Make predictions based on prior experiences. | | |
| K-2 | (INV) Make observations and/or measurements of a proposed object, tool, or solution to determine if it solves a problem or meets a goal. | 24-27 | SIN 502 Predict the results of an additional trial or measurement in an experiment. |
| K-2 | (DATA) Compare predictions (based on prior experiences) to what occurred (observable events). | 24-27 | SIN 503 Determine the experimental conditions that would produce specified results. |
| 3-5 | (INV) Make predictions about what would happen if a variable changes. | 28-32 | SIN 602 Determine an alternate method for testing a hypothesis. |
| 3-5 | (Q&P) Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. | 33-36 | SIN 702 Predict the effects of modifying the design or methods of an experiment. |
| 3-5 | (DATA) Analyze data to refine a problem statement or the design of a proposed object, tool, or process. | 33-36 | SIN 703 Determine which additional trial or experiment could be performed to enhance or evaluate experimental results. |
| 6-8 | (INV) Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence tha meet the goals of the investigation. | | |

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| 6-8 | (INV) Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. | | |
| 6-8 | (DATA) Distinguish between causal and correlational relationships in data. | | |
| 9-12 | (INV) Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables. | | |
| 9-12 | (INV) Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements, and consider limitations on the precision of the data and refine the design accordingly. | | |
| 9-12 | (INV) Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated. | | |
| 9-12 | (DATA) Evaluate impact of new data on a working explanation and/or model of a proposed process or system. | | |

| By engaging students in doing the SEPs:<br>Developing and Using Models (MOD)<br>Engaging in Argument from Evidence (ARG)<br>Constructing Explanations and Designing Solutions (E&S)<br>Obtaining, Evaluating, and Communicating Information (INFO) | | I can also address the ACT Science Skill:<br>Evaluation of Models, Inferences, and Experimental Results (EMI) | |
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| **Grade Band** | **SEP Objective** | **Score Range** | **Code and ACT Science Skill** |
| K-2 | (MOD) Compare models to identify common features and differences. | | |
| 3-5 | (MOD) Identify limitations of models. | | |
| 3-5 | (E&S) Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real world phenomena, examples, or events. | 13-15 | EMI 201 Find basic information in a model (conceptual). |
| | | 16-19 | EMI 301 Identify implications in a model. |
| 6-8 | (MOD) Evaluate limitations of a model for a proposed object or tool. | 20-23 | EMI 402 Identify key assumptions in a model. |
| 6-8 | (E&S) Construct an explanation using models or representations. | 20-23 | EMI 404 Identify similarities and differences between models. |
| 6-8 | (E&S) Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. | 24-27 | EMI 503 Identify the strengths and weaknesses of models. |
| 9-12 | (ARG) Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. | 28-32 | EMI 603 Use new information to make a prediction based on a model. |

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| 9-12 | (E&S) Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. | | |
| 9-12 | (E&S) Use evidence to construct or support an explanation or design a solution to a problem. | | |
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| K-2 | (INFO) Describe how specific images support a scientific or engineering idea. | | |
| K-2 | (ARG) Identify arguments that are supported by evidence. | | |
| K-2 | (ARG) Construct an argument with evidence to support a claim. | | |
| 3-5 | (E&S) Identify the evidence that supports particular points in an explanation. | 16-19 | EMI 302 Determine which models present certain basic information. |
| 3-5 | (E&S) Use evidence to support an explanation. | 20-23 | EMI 403 Determine which models imply certain information. |
| 3-5 | (INFO) 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. | 24-27 | EMI 504 Determine which models are supported or weakened by new information. |
| 3-5 | (ARG) Compare and refine arguments based on an evaluation of the evidence presented. | 28-32 | EMI 602 Determine whether presented information, or new information, supports or weakens a model, and why. |
| 3-5 | (ARG) Construct and/or support an argument with evidence, data, and/or a model. | | |
| 6-8 | (E&S) Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion. | | |

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| 9-12<br><br><br><br><br>9-12<br><br><br><br><br>9-12 | (MOD) Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.<br><br>(MOD) Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.<br><br>(ARG) Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence. | | |
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| K-2<br><br><br>K-2<br><br><br>K-2<br><br><br>K-2<br><br><br>3-5 | (E&S) Generate and/or compare multiple solutions to a problem.<br><br>(ARG) Analyze why some evidence is relevant to a scientific question and some is not.<br><br>(ARG) Distinguish between explanations that account for all gathered evidence and those that do not.<br><br>(ARG) Listen actively to arguments to indicate agreement or disagreement based on evidence and/or to retell the main points of the argument.<br><br>(E&S) Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. | 20-23<br><br><br><br><br>24-27<br><br><br><br><br>24-27<br><br><br><br><br>24-27 | EMI 401 Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text.<br><br>EMI 501 Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text.<br><br>EMI 502 Determine whether presented information, or new information, supports or contradicts a simple hypothesis or conclusion, and why.<br><br>EMI 505 Determine which experimental results or models support or contradict a hypothesis, prediction, or conclusion. |

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| 3-5 | (ARG) Use data to evaluate claims about cause and effect. | 28-32 | EMI 601 Determine which complex hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text. |
| 3-5 | (ARG) Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. | 33-36 | EMI 701 Determine which complex hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text. |
| 3-5 | (ARG) Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions. | 33-36 | EMI 702 Determine whether presented information, or new information, supports or contradicts a complex hypothesis or conclusion, and why. |
| 6-8 | (E&S) Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. | | |
| 6-8 | (INFO) Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings. | | |
| 6-8 | (INFO) Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts. | | |
| 6-8 | (INFO) Gather, read, synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. | | |
| 6-8 | (ARG) Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts. | | |

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| 6-8 | (ARG) Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration. | | |
| 9-12 | (E&S) Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. | | |
| 9-12 | (INFO) Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source. | | |
| 9-12 | (INFO) Compare, integrate, and evaluate sources of information presented in different media or formats in order to address a scientific question or solve a problem. | | |
| 9-12 | (ARG) Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues. | | |
| 9-12 | (ARG) Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merit of arguments. | | |
| 9-12 | (ARG) Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions. | | |