Subject-Area Lesson Planning Tool: Science

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INTRODUCTION

Science educators stimulate students' interests in science and help develop their ability to recognize patterns and formulate questions and answers about the world around them. These skills prepare students to use science to drive innovation now and when they enter the workforce. To fulfill these goals, students need to develop multiple social emotional competencies, for example, understanding cause and effect (i.e., how one's emotions influences themselves and others), demonstrating empathy and perspective taking, and engaging in discussions and debates using evidence.

"Social emotional learning (SEL) is a process through which individuals build awareness and skills in managing emotions, setting goals, establishing relationships, and making responsible decisions that support success in schools and in life." -- OSPI

Washington Office of Superintendent of
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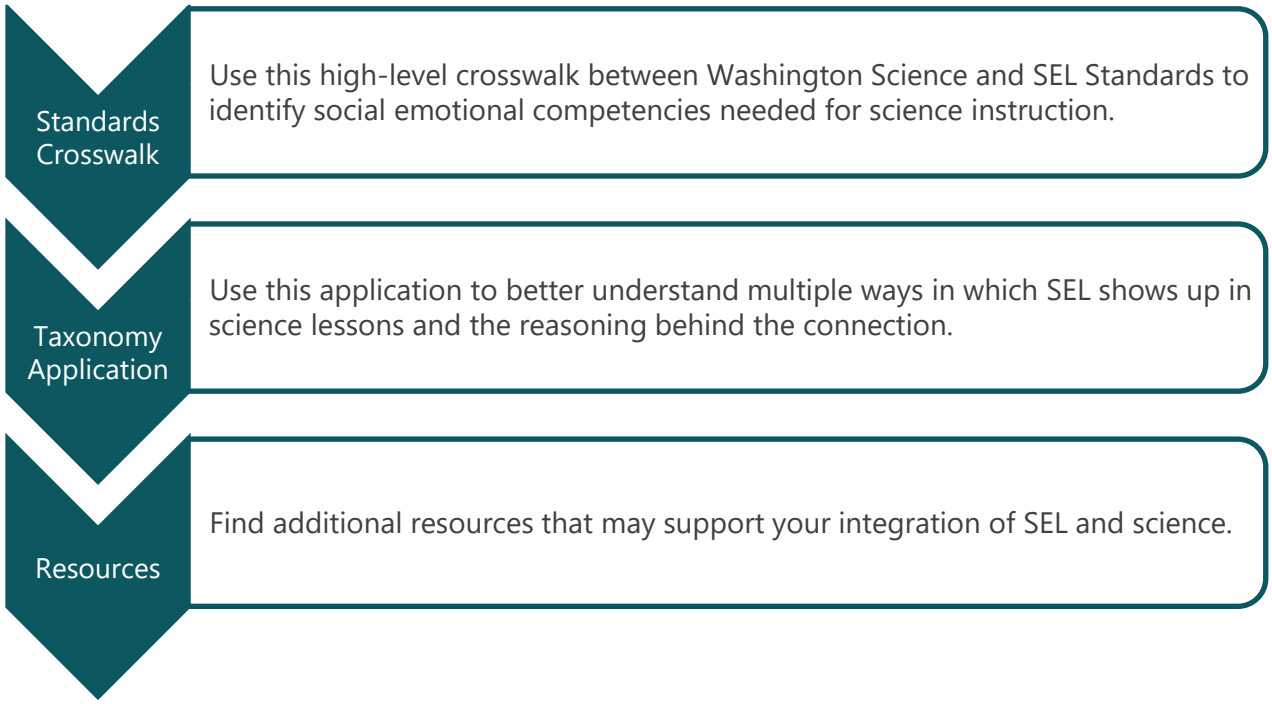
Table of Contents

How to Use This Tool

The TPEP Student Growth Goal Rubrics tell us that effective science instruction "relies heavily on the teacher's knowledge of students' cultural, academic, and social/emotional assets." This lesson planning tool supports science educators in Washington as they intentionally plan ways to nurture social emotional competencies within their academic lessons. The tool is scaffolded for your use and includes a standards crosswalk, application of how the standards align, and additional resources (see Figure 1 for a road map of how to use this tool). You can use the questions for reflection in each section to customize these strategies for your classroom.

Figure 1. Road Map for Using the Lesson Planning Tool



Questions for Reflection

Before advancing to the next section, reflect on some of your own assumptions and beliefs:

- How do you see social emotional competencies align with specific science standards? Which social emotional competencies do science scholars (e.g., researchers, chemists, and engineers) tend to use? How do you encourage students' development of those competencies?
- How do teachers explicitly connect social emotional competencies to effective teaching practices (the four Affirming Learning Environment practices in Module 2 and the Lesson Design Practices in Module 3) to promote students' mastery of science standards? How do you reinforce students' use of those competencies?
- What social emotional competencies do you use to create the conditions for the kind of learning necessary for all students to develop science skills and engage with science content

and practices?

CROSSWALK OF THE WASHINGTON SCIENCE LEARNING STANDARDS AND THE SEL STANDARDS

The Washington science learning standards are the Next Generation Science Standards (NGSS). The NGSS and the Framework for K–12 Science Education identify scientific and engineering practices, crosscutting concepts, and core ideas in science that all K–12 students should master to prepare for success in college and 21st century careers. The NGSS provides a vision for how these three dimensions integrate for authentic learning. There are eight scientific and engineering practices that are essential for learning science and require a variety of social emotional competencies. To get started, review the high-level crosswalk between the eight science and engineering practices and the SEL Standards and Benchmarks.

Science and Engineering Practice 1	Example Alignment with Washington SEL Standards
Asking Questions and Defining Problems Students ask questions—of others, of the texts they read, of what they observe, and conclusions they make from evidence. They further ask questions to understand and clarify problems. Asking questions often leads students to use another practice.	To be successful in asking questions and defining problems, students will use the following social emotional competencies: • Understand internal and external influences on one's emotions and behavior (Self-Awareness 1A and 1C). • Open to learning the variation of others' emotions, perspectives, cultures, languages, histories, identities, and abilities (Social Awareness 4A and 4C). • Effectively communicate with others to compare problems and resolve conflicts in constructive ways (Social Management 5C and 5B).
Developing and Using Models Students use models to represent systems, to support the development of further questions, to make predictions by generating evidence, and to communicate ideas. Students use evidence to develop and use models, but also use them to gain new insights and modify when needed. Students also recognize the limitations of the models.	To be successful in developing and using models, students will use the following social emotional competencies: • Effectively communicate one's thoughts and perspectives (Social Management 5A). • Demonstrate awareness that others may think, feel, and communicate differently based on a variety of influences from culture, language, history, identity, and ability (Social Awareness 4A and 4B). • Evaluate problems and potential solutions, and responsibly decide which solution is best (Self-Management 2B).

[1] Definitions come from Next Generation Science Standards (NGSS), including Appendix F.

Science and Engineering Practice 1	Example Alignment with Washington SEL Standards
Planning and Carrying Out Investigations Students plan for and carry out both teacher and student driven investigations to describe something, test a theory, or to fix or improve something. Students should state the goal of an investigation, predict the possible outcomes, and develop a plan to carry out the investigation	To be successful in planning and carrying out investigations, students will use the following social emotional competencies: • Work independently and with others to set, monitor, adapt, persevere, achieve, and evaluate goals (Self-Efficacy 3A and Social Engagement 3B) for science investigations. • Demonstrate awareness of one's personal strengths and areas for growth (Self-Awareness 1B) to improve science investigations. • Problem solve and engage in responsible decision making (Self-Management 2B and Self-Efficacy 3B) when carrying out an investigation.
Analyzing and Interpreting Data Students make sense and bring out the relevance of the data produced during investigations by using a range of tools such as tables, graphs, and other visualization techniques. They are able to compare and contrast data collected by different groups, analyze data to make sense of phenomena, and use data to refine solutions.	To be successful in analyzing and interpreting data, students will use the following social emotional competencies: • Demonstrate awareness of one's own emotions and influences (Self-Awareness 1A and 1C) while analyzing and interpreting data. • Grow in awareness of similarities and differences among communities, culture, and social groups, and gain an understanding of the variations within and across cultures (Social Awareness 4B and 4C). • Understand and accept that there are a variety of perspectives (Self-Efficacy 3C) and be aware of personal biases of others (Social Awareness 4C) when comparing different interpretations of data.
Using Mathematics and Computational Thinking Students use mathematics as a tool to address scientific questions and engineering problems. Students also use mathematical tools to help observe, collect, analyze, and represent data. Further, students engage in computational thinking (e.g., organizing data, creating sequences of steps, and using or developing simulations).	To be successful in using mathematics and computational thinking, students will use the following social emotional competencies: • Manage one's emotions, thoughts, impulses, and stress in constructive ways to deliberately engage in systematic, challenging tasks (Self-Management 2A). • Outline, set, and achieve goals with responsible decision making (Self-Efficacy 3A and 3B) to address scientific questions and engineering problems. • Observe and identify environmental influences on behavior (Social Awareness 4A).

Science and Engineering Practice 1	Example Alignment with Washington SEL Standards
Constructing Explanations and Designing Solutions Students construct their own scientific explanations and apply the explanations that they learn. Specifically, students develop claims about how variables relate to one another, typically made in response to a scientific question. For engineering, students can identify problems, and then generate, test, and evaluate the solutions to those problems, including generating the constraints and criteria for the solutions.	To be successful in constructing explanation and designing solutions, students will use the following social emotional competencies: • Display a range of communication skills to interact effectively with others (Social Management 5A). • Work with others to monitor, achieve, and evaluate processes (Social Engagement 6B). • Be aware of one's emotions and their impact on one's behavior (Self-Awareness 1A). • Respectfully express a difference of opinion (Self-Efficacy 3C) and identify ways to resolve conflicts effectively (Social Management 5B).
Engaging in Argument From Evidence Students engage in discussions to advocate for an idea, explain a finding, or provide solutions to a problem. Their argument includes using data and evidence to discuss and reconcile competing claims or ideas. An argument includes supporting one's own claim, while also evaluating and critiquing competing arguments and solutions.	To be successful in engaging in argument from evidence, students will use the following social emotional competencies: • Display a range of communication skills to interact effectively and engage respectfully with others whose opinions and experiences differ from one's own (Social Management 5A and 5C) as it relates to evidence and competing claims. • The ability to speak on behalf of one's own views and rights (Self-Efficacy 3C) regarding scientific arguments. • Demonstrate an understanding of variation within and across cultures, including understanding personal biases and strength of evidence (Social Awareness 4C) within scientific claims.
Obtaining, Evaluating, and Communicating Information Students read, understand, and produce scientific and technical text. Students become critical consumers of the text that they read (e.g., recognize salient information, identify sources of error or flaws in methodology, and distinguish claims from evidence). Students are further able to communicate clearly and persuasively scientific information and ideas through multiple means, such as through writing, graphs, and interactive displays.	To be successful in obtaining, evaluating, and communicating information, students will use the following social emotional competencies: • Awareness of one's internal and external influences and their impact on personal biases (Self-Awareness 1A and 1C) as they read and produce scientific and technical texts. • Desires to contribute to the well-being of one's school and classroom through collaborative group work (Social Engagement 6A and 6B) to evaluate and communicate scientific information. • Display a range of communication skills to interact effectively with others (Social Management 5A) and communicate scientific ideas.

Questions for Reflection

- How did the information in the crosswalk align with your existing knowledge of the relationships between science and SEL? Were there new ideas that broadened your thinking about the relationships between these areas? What questions emerged for you as you reviewed this crosswalk?[2]
- What Affirming Learning Environment practices (e.g., Warmth and Support, Responsibility and Choice, Student-Centered Problem Solving) and Learning Design practices (e.g., Balanced Instruction, Cooperative Learning, Self-Assessment and Self-Reflection) might facilitate students' development and application within these examples?
- How can you ensure that you incorporate students' personal and cultural strengths and assets as you continue to nurture social emotional competencies in instruction related to science?

TAXONOMY APPLICATION

Now that you have had a chance to explore, at a high level, some alignment between the science disciplines and the SEL standards, review some concrete ways to ensure that you are meeting your students' SEL needs within the science curriculum. Specifically, you will review concrete examples of how various SEL Standards and Benchmarks connect to the science and engineering practices. As you review these examples, ask yourself the following questions as you begin to plan your own science lessons that more intentionally integrate and nurture social emotional competencies. The following questions are based on the SEL–Academic Integration Taxonomy that you have been learning about in the module series Academic Learning Is Social and Emotional: Equity-Centered Social Emotional Learning in Washington.

1. **Explicit skill alignment:** Which SEL standards include *the same* skills, knowledge, and mindsets as those within the science and engineering practices?
2. **Explicit strategy alignment:** What social emotional competencies within the SEL standards do students use to accomplish specific science tasks?
3. **Ways of interacting:** How do students use their social emotional competencies within the SEL standards to participate in activities that help them learn science skills and content?
4. **Ways of being:** What social emotional mindsets and habits do science scholars (e.g., researchers, chemists, and engineers) develop to be successful?

As you consider these examples, remember that the goal for you as an educator is to create the conditions that encourage students to develop, apply, and exhibit their social emotional

[2] These three question prompts are adapted from the Project Zero Thinking Routine *Connect, Extend, Challenge*, https://pz.harvard.edu/resources/connect-extend-challenge.

competencies while mastering science content. The questions and examples in the table that follows can help you begin to intentionally integrate these efforts.

Science and Engineering Practices: Examples[3]

Science and Engineering Practice	Taxonomy Approach & SEL Standard and Benchmark	Reasoning
Asking Questions Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships (4-PS3-3).	Explicit skills alignment and Social Management 5A (demonstrates a range of communication and social skills to interact effectively with others.)	The science standard invites students to ask effective questions and clearly communicate their predictions about various scientific patterns and relationships, which are core components of effective communication and social skills. In other words, we are asking them to engage using the same skills—asking questions!

Science and Engineering Practice	Taxonomy Approach & SEL Standard and Benchmark	Reasoning
Planning and Carrying Out Investigations 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 (5-PSI-4).	Ways of Being and Social Engagement 6B (Demonstrates the ability to work with others to set, monitor, adapt, achieve, and evaluate goals.)	Collaboration is necessary for scientists as they conduct investigations and evaluate the quality of evidence generated by those investigations. This collaboration includes working with others to set goals for the investigation, as well as determine the types of scientific evidence that will help them meet those goals. Thus, scientists have a specific way of being as they plan for and conduct investigations, and students practice this way of being as they practice Social Engagement Standard 6B.

[3] Examples come from the DCI Arrangements of the NGSS.

Science and Engineering Practice	Taxonomy Approach & SEL Standard and Benchmark	Reasoning
Analyzing and Interpreting Data Analyze and interpret data to make sense of phenomena using logical reasoning (4-ESS2-2).	Explicit strategy alignment, Self-Awareness 1C (Demonstrates self-awareness and understanding of external influences, e.g., culture, family, school, and community resources and supports.)	As students analyze and interpret data, it will be important for them to pay attention to biases, assumptions, and stereotypes that they might have and how those biases can impact findings, investigation procedures, and logical reasoning. By paying attention to their biases in science, they can more objectively analyze and interpret data.

Science and Engineering Practice	Taxonomy Approach & SEL Standard and Benchmark	Reasoning
Engaging in Argument From Evidence 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 (3-5SS3-1).	Ways of Interacting and Social Management 5C (Demonstrates the ability to engage in respectful and healthy relationships with individuals of diverse perspectives, cultures, language, history, identity, and ability.)	When students are using evidence to make a claim about a solution, they are effectively communicating their thoughts and findings, potentially to others who have diverse perspectives. Educators can teach a mini lesson about how to communicate with respect and professionalism to support students' use of social management skills while engaging in arguments from evidence.

Questions for Reflection

- What did you learn from these taxonomy examples? What does it mean to intentionally embed social, emotional, and academic competencies in science?
- What are some questions you may ask yourself to become more intentional in your approach to SEL–academic integration?
- How can you incorporate multiple, lived experiences and interpretations through a more intentional SEL–academic integration approach in science?

Additional Resources

- Social and Emotional Learning in Science Class (Edutopia)
- Science Class is a Great Place for Social and Emotional Learning (Fordham Institute)
- Social and Emotional Learning within Science Education (WestEd)
- Learn about Social-Emotional Learning and How to Foster It in STEM Learning Environments (Let's Talk Science)
- Social and Emotional Learning in the 3-D Science Classroom (Building Blocks of Science)
- From Surviving to Thriving: Teaching Social Emotional Learning Alongside the NGSS (National Science Teachers Association)

LEGAL NOTICE

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American Institutes for Research®
1400 Crystal Drive, 10th Floor
Arlington, VA 22202-3289
202.403.5000 | **AIR.ORG**

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