# Integrating Oregon's Transformative SEL and K-12 Science Education

# Table of Contents

## Introduction

In June 2023, the State Board of Education adopted the Oregon Transformative Social and Emotional Learning (TSEL) Standards & Practices that represent K-12 social and emotional learning (SEL) expectations for students. Oregon's Transformative SEL Framework is intended to enact ORS 329.045 and strengthen equity-focused school cultures **that support student and adult well-being**. K-12 science instruction provides a rich opportunity for teaching and practicing SEL to deepen and improve learning while affirming students' personal, cultural, racial, linguistic, and academic identities. Below are the transformative social and emotional learning standards.

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| **Self-Awareness & Identity:** Identify and reflect upon one's thoughts, emotions, behaviors, intersectional identity, and capabilities across situations and environments. |
| **Self-Management & Agency**: Use management strategies to build personal and collective agency that lead to achieving goals and aspirations. |
| **Social-Awareness & Belonging:** Develop social awareness that fosters a sense of belonging and leads to co-constructing equitable, thriving communities and a vibrant society. |
| **Relationship Skills & Collaborative Problem-Solving:** Establish and maintain healthy, supportive relationships and effectively navigate diverse settings in order to collaboratively solve problems. |
| **Responsible Decision Making & Curiosity:** Demonstrate curiosity and analysis of oneself and society in order to make caring choices that impact personal, social, and collective well-being across situations and environments. |

## Purpose

This document serves as a companion to the **Science Oregon Teacher's Guide and Lesson Sparks**, which **should be read first** to understand the foundational connections between Transformative SEL (TSEL) and science education. It affirms that all learning, including K–12 science education, integrates social and emotional competencies essential for fostering human connection and building caring, just, inclusive, and healthy school environments. Social and emotional learning is crucial not only for fostering a positive school climate but also for supporting students' personal relationships and overall well-being, while preparing them to positively impact their communities and contribute meaningfully to the workforce. As Transformative SEL is an ongoing process, this document provides strategies for teachers to integrate SEL practices into their instruction, supporting the development of these essential skills and capacities.

The science classroom is an ideal place to cultivate students' TSEL practices and principles. Since the 2012 release of the NRC's A Framework for K-12 Science Education, science instruction has shifted toward authentic connections to students' lives and interests, while also deepening their understanding of the knowledge and skills needed in collaborative scientific and engineering professions. In classrooms that create the conditions for student-centered learning environments, instruction is guided by students'

questions and curiosities, experiences, and ideas, creating space for their voices to shape the learning process and drive collective sensemaking.

**Science educators play a critical role in fostering students' interest and curiosity in science** while developing their ability to recognize patterns, ask questions, and investigate the world around them. These abilities build essential skills essential for civic engagement and future careers, but also for students' personal growth by strengthening their critical thinking, confidence, collaboration, and ability to navigate an increasingly complex world. To fully prepare students, instruction and conditions for learning and thriving, must also support the development of social and emotional competencies such as empathy, perspective-taking, and evidence-based communication. A TSEL approach helps achieve this by creating inclusive environments where students feel a sense of belonging, reflect on their learning, and contribute to the classroom community. The conditions ensure that students feel free to envision and explore how science plays a role in creating the communities and society they want to live in.

Use these **reflection questions** to **examine beliefs, identities, and teaching practices** to identify the way social and emotional skills are modeled and regulate in the classroom.

- How are the variety of cultures and perspectives viewed as an asset to support culturally responsive pedagogy? How are scientists and engineers from diverse backgrounds represented in the classroom?
- What opportunities can help students develop and show science skills and ideas while supporting social, emotional, and cultural competencies?
- How are students provided connections to and importance of their daily lives, homes, neighborhoods, and communities within science lessons?

## Guiding Principles and Integration

Oregon has taken an intentional approach to TSEL that engages the entire school community (students, families & caregivers, educators, and community partners) and is anchored in five guiding principles that are foundational when implementing TSEL. These include:

1. **Culturally responsive**
2. **Community responsive**
3. **Strengths-based**
4. **Trauma-informed**
5. **Grounded in neuroscience**

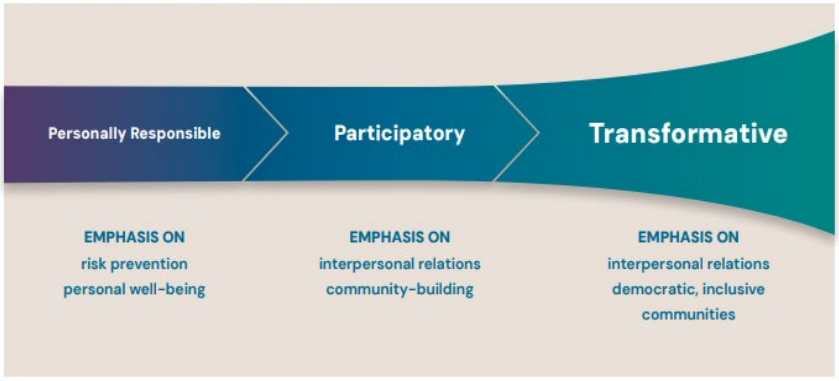
While science learning is often embedded into lessons or units that are graded, the development of **students' TSEL skills should remain ungraded**. These skills, such as self-awareness, empathy,

collaboration, and responsible decision-making, are nurtured through reflection, relationship-building, and meaningful engagement, not through traditional assessments. Prioritizing growth over grading in this area helps create a supportive environment where students can authentically develop and apply these competencies. The TSEL standards include practices with relevant growth indicators to provide guidance on what social and emotional growth may look like in action and indicate growth towards the practice and standards. The TSEL standards are not meant to prescribe a single set of behaviors and should not be used as a means for identifying, tracking, or excluding students in ways that have historically led to disproportionate outcomes. In partnership with families and caregivers, the standards, when used in partnership with families and caregivers, provide ongoing formative opportunities for reciprocal feedback through dialogue, reflection, goal setting, and increasing both individual and collective awareness and growth. Educators play a key role in creating meaningful opportunities for students to practice and demonstrate their knowledge and skills, helping them reflect on what they have learned, recognize their strengths, and identify areas where they may need additional support.

## Continuum of Transformation

A transformative approach to SEL is not confined to a single person, lesson, or specific time of the day and is not a one-size fits all program or curriculum. Instead, it is an ongoing process and practice of how adults and students show up for one another in moments throughout the school day. SEL practices exist on a continuum, moving from personally responsible and participatory SEL to a Transformative SEL approach (Figure 3).

Figure 3. Continuum of Transformation




## How to Use This Resource

This resource highlights areas where the K-12 Oregon Science Standards, specifically the Science and Engineering Practices (SEPs), support students' transformative social and emotional growth by reinforcing key connections and promoting coherence, consistent language use, and alignment between these standards. By exploring naturally occurring phenomena and engaging in meaningful discourse, students

are able to build critical thinking skills and deepen their scientific knowledge, all while nurturing a classroom community that cultivates curiosity, wonder, and joy. In this environment, students can learn together, feel safe sharing their ideas, and give one another the time and space to engage in meaningful discussions.

The following tables are organized according to the Transformative SEL Standards and their corresponding practices. They explicitly highlight the connections to the Science and Engineering Practices (SEPs) and include the following elements:

- **TSEL Standards & Practices:** The practices describe what a person needs to know, understand, and be able to do when it comes to each TSEL Standard. In addition, each TSEL Practice demonstrates progression towards meeting the specific TSEL standard with more focused knowledge and skill.
- **Science & Engineering Practices:** The eight science and engineering practices describe how students should engage in building scientific knowledge, similar to how scientists and engineers work. These practices are what students use to make sense of phenomena. They are both a set of skills and a set of knowledge used to investigate the world and to design and build systems.
- **Connection Examples:** These examples are designed to support educators in connecting the TSEL standards to teaching and learning in science education and to support science educators with what instructional practices can look like when the TSEL standards are integrated.

## TSEL and Science

All science learning can be understood as a cultural accomplishment (National Research Council, 2012) and building a classroom environment centered on TSEL requires educators to reflect on their identities and the ways in which their lived experiences shape their interactions and expectations. By prioritizing relationships, care, and social-emotional learning strategies, educators can cultivate a sense of belonging among students. It is equally important to set aside time to tend to one's own care, healthiness, and well-being —whether through reflection, mindfulness, or engaging in activities that bring joy—to ensure educators remain intellectually and emotionally present but also model the regulation skills that help students thrive in a supportive learning environment.

**Please note** – The layout of the crosswalks below centers the TSEL Standards and their connections to the Science and Engineering Practices (SEPs). The layout is in a different format than Appendix A in the Science TSEL Sparks document, however, **the information provided remains exactly the same.**

# TSEL Standard 1: Self-Awareness & Identity

**Self-Awareness & Identity Standard:**

Identify and reflect upon one's thoughts, emotions, behaviors, intersectional identity, and capabilities across situations and environments.

**Questions to consider:** How do you know what you are thinking? How can you become more aware of your thoughts and feelings?

| Standard 1 TSEL Practices | Related Science & Engineering Practice |
|---|---|
| • **1A:** Identify and label emotions, thoughts, strengths, and potential (both personal and cultural).<br><br>• **1C:** Reflect on and evaluate how one's emotions, thoughts, and perspectives (including values, biases, and prejudices) can influence behavior.<br><br>• **1D:** Analyze personal and social intersectional identities and positionality, and how they relate to one's interests, purpose, and sense of belonging. | **Asking Questions and Defining Problems**<br>Students ask questions to understand texts, observations, evidence, and problems, often leading to further inquiry (1A).<br><br>**Engaging in Argument from Evidence**<br>Students engage in evidence-based discussions to communicate ideas, explain findings, and evaluate competing claims by critiquing alternatives arguments and solutions (1C and 1D). |

## Science Connections to Self-Awareness & Identity

By drawing explicit connections between science, **self-awareness, and identity,** students are encouraged to deepen their understanding of themselves while engaging in scientific practices. By identifying their emotions, thoughts, strengths, and cultural backgrounds, students build a foundation for self-awareness. This process not only fosters acceptance of their unique ways of knowing but also prepares them to engage in critical reflection. It also encourages them to engage with different perspectives confidently, understanding how their emotions, values, biases, and perspectives influence their behavior and decision-making.

## Connection Examples of Self-Awareness & Identity in Science Learning

- **Science Autobiographies**: Encourage students to reflect on their past science experiences and explore their emotions and attitudes toward science – whether excitement, curiosity, frustration, or uncertainty. This type of activity helps students see that science is already a part of their lives.
- **Neighborhood Walks**: Go on walks in the school's neighborhood and observe scientific phenomena related to curriculum topics. Discuss how these observations connect to the students' own experiences in their community.
- **Family & Community Connections**: Engage families and community members by having students interview them about their experiences with science, cultural knowledge or local environmental issues. This highlights the diverse ways science exists in different contexts and acknowledges the value of Indigenous ways of knowing and Native Science.

## Resources

- Framework for Gender Inclusive Biology: This framework provides a guiding set of principles for teachers to reflect on ways to expand their curriculum to be more inclusive of all students.
- Helping Students Make Sense of the World – Toward more Equitable Learning in Science: This chapter outlines strategies to expand meaningful science learning by noticing, supporting, and engaging students' diverse sense-making as integral to scientific practice and knowledge.
- Learning in Places Framework - Why is thinking about culture, learning, and identity important for educators?: This framework highlights that equitable science instruction must address both equity in learning and the cultural, historical, and social dimensions of scientific knowledge, recognizing that science is shaped by identity, power, and diverse global contributions.
- STEM Teaching Tool - Addressing Potential Barriers to Science Learning: This resource offers support for deep and meaningful science learning by proactively addressing to potential barriers such as lecture-based learning, inaccessible materials, unsupported collaboration, and biased language through the intentional design of accessible learning environments from the onset.
- STEM Teaching Tool - Attending to Race and Identity in Science Instruction: This resource recognizes race as a socio-political construct and provides ways to support students from historically and systemically marginalized communities to see themselves in science.

# TSEL Standard 2: Self-Management & Agency

**Self-management & Agency Standard:**

Use management strategies to build personal and collective agency that lead to achieving goals and aspirations.

**Questions to consider:** How do you stop yourself from saying things you should or should not? Why might it be good for people to think carefully about what they say to others?

| Standard 2 TSEL Practices | Related Science & Engineering Practice |
|---|---|
| • **2A:** Manage and express thoughts, emotions, impulses, and stressors in ways that affirm one's identity.<br><br>• **2B:** Use management strategies while recognizing that various situations and environments may require different approaches for achieving personal and collective goals and aspirations in ways that affirm one's identity.<br><br>• **2C:** Plan, evaluate, and achieve personal and collective goals and aspirations.<br><br>• **2D:** Develop personal and collective agency by using various forms of communication (i.e., verbal, body language, written, etc.) to make choices and take initiative. | **Asking Questions and Defining Problems**<br>Students ask questions to understand texts, observations, evidence, and problems, often leading to further inquiry (2A).<br><br>**Developing and Using Models**<br>Students use evidence-based models to represent systems, generate questions, make predictions, communicate ideas, gain insights, and refine their understanding while recognizing possible limitations of their models (2A).<br><br>**Planning and Carrying Out Investigations**<br>Students should state the goal of a designed investigation, predict the possible outcomes, and develop a plan to carry out the investigation (2B, 2C and 2D).<br><br>**Constructing Explanations and Designing Solutions**<br>Students construct and apply scientific explanations by making claims about variable relationships in response to questions, and in engineering, they identify problems, define criteria and constraints, generate, test, and evaluate solutions (2B and 2C).<br><br>**Obtaining, Evaluating, and Communicating Information**<br>Students gather, read, and analyze scientific and technical texts, critically evaluating the content and effectively communicate ideas through writing, graphs, and interactive displays (2A and 2D). |

## Science Connections to Self-Management & Agency

Engaging students in explaining phenomena helps develop their self- management and agency by supporting them in understanding and expressing their thoughts, emotions, and stress in ways that affirm their identities. In this way, students are able to apply different strategies depending on the situation to achieve personal and collective goals, while planning, evaluating, and working toward these goals with intention. Through scientific practices like asking questions and defining problems, students build agency through the use of diverse forms of communication to make informed choices, take initiative, and actively engage in their learning and growth.

## Connection Examples of Self-Management & Agency in Science Learning

- **Student-designed Investigations:** Allowing students to pose their own questions and design their own investigations which could involve exploring the physics of their favorite sport or creating a model depicting the transfer of energy in their garden. This empowers students to take ownership of their learning, fostering deeper understanding and critical thinking skills necessary for lifelong success.
- **Relating Science to Current Events:** Discuss how science is relevant to current events and construct opportunities to connect their scientific understanding to address problems and challenges in their communities. For example, integrating opportunities for action and civic engagement, educators can foster a sense of ownership and encouraging students to become catalysts for climate action in their communities.
- **Peer Feedback and Self-assessment**: Encouraging students to provide both constructive and empowering feedback to their peers and to self-assess their own learning can enhance their understanding of expectations and foster a sense of ownership over their progress.

## Resources

- Climate Emotions Toolkit for Educators: This toolkit is designed to help educators address climate change emotions by equipping educators with strategies to manage their own emotions and support student well-being.
- STEM Teaching Tool - How can I foster curiosity and learning in my classroom? Through talk!:This resource outlines specific instructional talk formats and provides guidance on when, how, and why to use them to support students' three-dimensional science learning and increase meaningful sense-making through classroom discussion.
- STEM Teaching Tool - Multiple Means of Engagement in Science Education: This resource provides suggestions on authentic engagement for student choice by clarifying learning goals, fostering collaboration, and supporting student self-regulation through scaffolds and feedback to deepen participation and sense-making in science.
- Youth Climate Action Toolkit: This toolkit provides talking points, highlights advocacy strategies, and includes inspiring examples of students taking action around the country.

# TSEL Standard 3: Social Awareness & Belonging

**Social Awareness & Belonging Standard:**

Develop social awareness that fosters a sense of belonging and leads to co-constructing equitable, thriving communities and a vibrant society.

**Questions to consider:** How do you work to understand others' thoughts and feelings? What is the value in working to understand others' thoughts and feelings?

| Standard 3 TSEL Practices | Related Science & Engineering Practice |
|---|---|
| • **3A:** Demonstrate awareness and understanding of the similarities and differences that define, influence, and affirm personal and collective identities.<br><br>• **3B:** Apply social skills (i.e., empathy, compassion, etc.) to develop and maintain healthy relationships that collectively achieve mutual goals while affirming identities and perspectives.<br><br>• **3C:** Foster a sense of belonging that cultivates acceptance, support, inclusion, and encouragement of others within a diverse community, while addressing the impact of systemic injustices across situations and environments. | **Asking Questions and Defining Problems**<br>Students ask questions to understand texts, observations, evidence, and problems, often leading to further inquiry (3A).<br><br>**Planning and Carrying Out Investigations**<br>Students should state the goal of a designed investigation, predict the possible outcomes, and develop a plan to carry out the investigation (3B).<br><br>**Constructing Explanations and Designing Solutions**<br>Students construct and apply scientific explanations by making claims about variable relationships in response to questions, and in engineering, they identify problems, define criteria and constraints, generate, test, and evaluate solutions (3B and 3C).<br><br>**Engaging in Argument from Evidence**<br>Students engage in evidence-based discussions to communicate ideas, explain findings, and evaluate competing claims by critiquing alternatives arguments and solutions (3A and 3B).<br><br>**Obtaining, Evaluating, and Communicating Information**<br>Students gather, read, and analyze scientific and technical texts, critically evaluating the content and effectively communicate ideas through writing, graphs, and interactive displays (3A) |

## Science Connections to Social Awareness & Belonging

Incorporating **social awareness and a sense of belonging** into K–12 science education is essential for creating inclusive, equitable learning environments where all students feel respected, valued, and capable of participating in science. This approach supports engagement by connecting learning to students' identities and locally relevant phenomena. These social-emotional dimensions are key to fostering student well-being, deepening understanding, and broadening participation in science and engineering.

## Connection Examples of Social Awareness & Belonging in Science Learning

- **Take Others' Perspectives**: Encourage students to consider how different people and cultures view and interact with science and the natural world. Invite students to share how their families and communities interact with local ecosystems or explore the Essential Understandings of Native Americans in Oregon and Tribal History/Shared History lessons to gain a deeper understanding of historical and contemporary science context. This approach can enhance students understanding by broadening scientific viewpoints.
- **Recognize Strengths in Others:** Highlight diverse contributions to scientific discoveries and engineering innovations to emphasize that everyone can make meaningful contributions to scientific understanding and solve engineering problems.
- **Demonstrate Empathy and Compassion:** Explore issues such as equity, environmental justice, and the social responsibilities of scientists and engineers, fostering critical thinking about the broader impacts of technology and scientific progress on society.
- **Encourage Student Voice:** Provide opportunities for students to share their ideas, ask questions, and contribute to scientific investigations. This process cultivates critical thinking, independent reasoning, and communication skills, making learning more relevant and motivating for students.

## Resources

- Designing for Social Justice in Science Teaching and Learning: Working Toward Rightful Presence: This article introduces the concept of *Rightful Presence*, applying insights from critical justice studies to classrooms by advocating for shared power in STEM learning.
- Indigenous STEM – Story Arcs: These engagement activities are co-designed with communities to center Indigenous knowledge systems, support intergenerational learning, and foster respectful, place-based exploration.
- STEM Teaching Tool - How can students' everyday experiences support science learning through engineering design?: This practice brief highlights how adapting engineering curricula to include students' everyday experiences and local knowledge can make science learning more culturally relevant, meaningful, and effective in deepening science understanding through real-world problem-solving.

# TSEL Standard 4: Relationship Skills & Collaborative Problem-Solving

**Relationship Skills & Collaborative Problem-Solving Standard:**

Establish and maintain healthy, supportive relationships and effectively navigate diverse settings in order to collaboratively solve problems.

**Questions to consider:** What are some ways you build relationships with others? What are some ways you can improve your relationships with people in this class?

| Standard 4 TSEL Practices | Related Science & Engineering Practice |
|---|---|
| • **4A:** Form authentic relationships that encourage autonomy while building cultural awareness and empathy through various forms of communication.<br><br>• **4B:** Demonstrate empathy and affirm other's perspectives during teamwork and collaborative problem solving.<br><br>• **4C:** Recognize and acknowledge when there is harm to self and others and identify when support, agency, and practices to repair and restore are needed. | **Asking Questions and Defining Problems**<br>Students ask questions to understand texts, observations, evidence, and problems, often leading to further inquiry (4C).<br><br>**Constructing Explanations and Designing Solutions**<br>Students construct and apply scientific explanations by making claims about variable relationships in response to questions, and in engineering, they identify problems, define criteria and constraints, generate, test, and evaluate solutions (4B).<br><br>**Obtaining, Evaluating, and Communicating Information**<br>Students gather, read, and analyze scientific and technical texts, critically evaluating the content and effectively communicate ideas through writing, graphs, and interactive displays (4A). |

## Science Connections to Relationship Skills & Collaborative Problem-Solving

In K–12 science education**, relationship skills and collaborative problem-solving** are essential practices that not only enhance students' engagement in meaningful scientific learning but also equip them with the interpersonal and critical thinking tools needed to navigate authentic challenges. By intentionally cultivating relationship building, communication skills and collaborative problem-solving in science classrooms, educators can create inclusive learning environments that reflect the true nature of scientific work and prepare students to actively contribute to and engage with their communities.

## Connection Examples of Relationship Skills & Collaborative Problem-Solving in Science Learning

- **Participate in a Community Science Project:** Students can gather data through observation, like bird counting, weather tracking by measuring aspects of their local environment, or images from space or identifying exoplanets. This provides students with a sense of shared purpose, connections to the local community, or exploring a personal interest.
- **Co-constructed Knowledge:** This approach allows students to take intellectual risks by providing opportunities for sharing and building knowledge through iterations. Students develop and communicate initial, improved, and revised models based on evidence to explain a naturally occurring phenomena such as a "disappearing water puddle" while learning about the water cycle or the cycling of carbon in the ecosystems.
- **Authentic Problems:** Students could work collaboratively to investigate a local environmental issue like an algal bloom, requiring them to research causes, analyze data, and propose solutions.

## Resources

- Building a Science Classroom Community: This article uses ecology as a metaphor for the science classroom, encouraging educators to intentionally build thriving, inclusive learning communities where students, teachers, and curricula grow together through care, connection, and purposeful design.
- Designing Climate Change Learning for Action: This practice brief frames climate change learning through civic engagement and engineering design, empowering students to take meaningful, community-centered action within their spheres of influence and fostering hope in the face of environmental challenges.
- STEM Teaching Tool - Implementing Meaningful STEM Education with Indigenous Students & Families**:** This practice brief highlights how integrating Indigenous ways of knowing and Native Science into STEM fosters inclusive learning environments that support meaningful collaboration, cultural understanding, and collective decision-making by bridging school, family, and community knowledge systems.
- Keeping Climate Science Learning and Instruction Focused on Creating Solutions and Building Community Resilience: This practice brief provides examples and opportunities for learning about climate solutions through locally relevant, interdisciplinary curricula that support student well-being, civic engagement, and community-based action, especially for youth disproportionately affected by climate change.

# TSEL Standard 5: Responsible Decision-Making & Curiosity

**Responsible Decision Making & Curiosity Standard:**
Demonstrate curiosity and analysis of oneself and society in order to make caring choices that impact personal, social, and collective well-being across situations and environments.

**Questions to consider:** How do you know if you are making responsible decisions? What are some ways you can improve your decisions in this class?

| Standard 5 TSEL Practices | Related Science & Engineering Practice |
|---|---|
| • **5A:** Demonstrate curiosity and open-mindedness while using critical thinking skills across various situations and environments.<br><br>• **5B:** Make informed choices and identify solutions for personal and social injustices after analyzing all types of information.<br><br>• **5C:** Anticipate, reflect, and evaluate the impacts of one's choices and contributions in promoting personal, family, and community well-being. | **Developing and Using Models**<br>Students use evidence-based models to represent systems, generate questions, make predictions, communicate ideas, gain insights, and refine their understanding while recognizing possible limitations of their models (5A).<br><br>**Analyzing and Interpreting Data**<br>Students interpret and find relevance in investigation data by using tools like tables, graphs, and visualizations to compare results, analyze phenomena, and refine solutions. (5A and 5C).<br><br>**Using Mathematical and Computational Thinking**<br>Students use mathematics and computational thinking, including data organization, analysis, and simulation—to investigate scientific questions and solve engineering problems (5A and 5C).<br><br>**Constructing Explanations and Designing Solutions**<br>Students construct and apply scientific explanations by making claims about variable relationships in response to questions, and in engineering, they identify problems, define criteria and constraints, and generate, test, and evaluate solutions (5B).<br><br>**Engaging in Argument from Evidence**<br>Students engage in evidence-based discussions to communicate ideas, explain findings, and evaluate competing claims by critiquing alternatives arguments and solutions (5C). |

## Science Connections to Responsible Decision-Making & Curiosity

**Curiosity and responsible decision-making** are vital in K–12 science education, especially within the Oregon K12 Science Standards. Curiosity drives students to ask questions, explore phenomena, and engage deeply with scientific ideas, while responsible decision-making helps them critically evaluate evidence, consider consequences, and apply science to authentic problems. Together, these skills foster scientific literacy, support investigations of phenomena, and prepare students to make informed, ethical choices as future problem-solvers and engaged community members.

## Connection Examples of Responsible Decision-Making & Curiosity in Science Learning

- **Understanding Ethical Implications:** Students can examine how scientific discoveries and technologies have ethical considerations, like the development of genetic engineering or artificial intelligence. This encourages them to analyze problems, consider consequences to our society and planet, and make informed conclusions.
- **Identifying Solutions to Authentic Problems:** Students can identify problems, propose potential solutions, and evaluate their potential impact on individuals, communities, and the environment. For example, a project on designing a sustainable energy source requires students to consider different options and their consequences.
- **Analyzing Historical Contributors:** Encourage students to research scientists or historical figures who demonstrated strong ethics and responsible decision-making and analyze how those qualities influenced their work. Consider figures such as Marie Curie, whose integrity guided her scientific discoveries; Jonas Salk, who made responsible choices in the global distribution of the polio vaccine; George Washington Carver, who developed alternative agriculture techniques to reduce soil depletion or NASA's Mae Jemison (1992) and Colonel Nicole Mann (2013), who contributed to hundreds of experiments and technology demonstrations, including bone loss, motion sickness cardiovascular health, and bioprinting.
- **Phenomena-based Learning**: Students observe a real-world phenomenon that sparks their curiosity and leads them to ask questions and design investigations to find answers. For example, students could explore questions such as: How does plastic impact marine life and ecosystems? What can we do to protect sea ice and the species that depend on it? What steps can humans take to limit $CO_2$ emissions.

## Resources

- Designing and participating in community and citizen science efforts to support equity and justice: This practice brief provides guidance and examples for designing community and citizen science projects that center equity by engaging historically underrepresented groups as full collaborators, honoring diverse STEM knowledge systems, and supporting culturally responsive, community-driven learning and action.
- Learning in Places - "Should We" Questions, Models, and Preparing to Investigate!: This resource supports students in making thoughtful, values-driven decisions by exploring human-nature relationships, considering community and environmental impacts, and engaging in deliberation and action amid uncertainty.
- Learning in Places - Why is engaging in ethical deliberation and decision-making in socioecological phenomena important?: This resource explores why ethical deliberation and decision-making in socioecological phenomena is crucial because human choices shape evolving nature-culture relationships that profoundly impact ecological and social systems, requiring thoughtful, just, and sustainable responses to address complex global challenges.

## In Closing

Integrating TSEL practices within K–12 science classrooms is essential for nurturing not only students' academic growth but also their personal development and sense of belonging. The classroom is an ideal space for cultivating these practices as science instruction emphasizes authentic connections to students' lives and interests while preparing them with the knowledge and skills needed for scientific collaboration, engineering design, civic engagement, and community-based action. In the short term, TSEL supports inclusive and dynamic learning environments where students feel valued and empowered to take intellectual risks.

Over time, this cultivates critical life skills such as empathy, resilience, and collaborative problem-solving, enabling students to navigate complex challenges, contribute thoughtfully to their communities, and thrive in an ever-evolving world. In classrooms that embrace student-centered learning, instruction is guided by learners' questions, experiences, and ideas, allowing their voices to shape the learning process and drive collective sensemaking. Embedding TSEL in science education ensures that we are developing not only knowledgeable scientists and engineers, but also responsible, compassionate leaders of tomorrow.

# Glossary

## Agency

Agency confers the wherewithal to impact positively on this psychological and social reality. It reflects hope and self-direction. Agency is focal among self-management competencies and signifies perceived and actual capacity to effect change through purposeful action. This may include having a voice and making choices about learning and career goals, overcoming personal challenges, and engaging in collaborative problem solving. Agency is key to young adults' success, allowing them to take intentional actions to shape the course of their lives. Agency also includes collective efficacy, which has been shown to improve teachers' abilities to improve school outcomes for students from under-resourced communities and to increase coordinated actions among adolescents and adults that contribute positively to civic life (CASEL, n.d.).

## Belonging

Belonging suggests the sense of connectedness and trust needed to engage in co-constructing an equitable, thriving local community and vibrant civil society. It enhances self-worth. Belonging is focal among social awareness competencies and connotes experiences of acceptance, respect, and inclusion within a group or community. It implies not only feeling recognized but also being fully involved in relationship-building and co-creating learning spaces. Having a sense of belonging is critical to students' and adults' cognitive, social, and emotional well-being, as well as school and work satisfaction and academic motivation and achievement (CASEL, n.d.).

## Collaborative Problem-Solving

Collaborative problem-solving (not the Collaborative Problem Solving program) acknowledges and helps realize the collective rights and responsibilities of full citizenship in local, national, and global community contexts. It is a critical feature of efforts to pursue equity and excellence. Collaborative problem-solving is focal among relationship skills' competencies and reflects a complex skill set in high demand in our increasingly multifaceted local, national, and global contexts. Distinct from collaborative learning and collaborative decision-making, collaborative problem-solving is defined as the capacity of an individual to effectively engage in a process whereby two or more people attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills, and efforts to reach that solution (CASEL, n.d.).

## Curiosity

Curiosity reflects the deep need to continuously surface and curate information about oneself in relation to others and the physical world. It prioritizes informed decision-making based on open-minded investigation that sparks self-development and careful social analysis. Curiosity is focal among responsible decision-making competencies and can animate critical self- and social-analysis and action. Curiosity has both cognitive and affective elements that contribute to an enduring tendency to pursue knowledge and new experiences. As such, it appears to be essential to attention, engagement, and learning (CASEL, n.d.).

## Dysregulation

Patterns of emotional experience or expression that interfere with goal directed activity (Thompson, 2019).

## Identity(ies)

Identity implies understandings and sensibilities associated with multifaceted personal and social group statuses (often discussed in terms of intersectionality and positionality). Identity is focal among self-awareness competencies and refers to how students (and adults) view themselves. Identity can also be attributed onto others without consent or choice due to positionality, perception, and biases. Identity has many dimensions which intersect and influence one another (e.g., race/ethnicity, socioeconomic status, gender identity, sexual orientation, disability, language, religion, values, interests, etc.),

with each dimension having a level of importance and emotional tenor that may change over time in accordance with access to supportive, affirming, and culturally sustaining communities and treatment by others. Having a healthy sense of identity is important developmentally across the lifespan because it buffers against negative or traumatic experiences (e.g., stereotype threat or discrimination) and when supported and affirmed, contributes to positive academic, social, mental health, and emotional outcomes (adapted from CASEL, n.d.).

## Intersectionality

The complex, cumulative way in which the effects of multiple forms of discrimination (such as racism, sexism, and classism) combine, overlap, or intersect, especially in the experiences of marginalized individuals or groups. Kimberlé Crenshaw introduced the theory of intersectionality, the idea that when it comes to thinking about how inequalities persist, categories like gender, race, and class are best understood as overlapping and mutually constitutive rather than isolated and distinct (Merriam-Webster, n.d.).

## Positionality

Positionality refers to how differences in social position and power shape identities and access in society. This affects teaching, learning, leading, and common interactions (Adapted from University of British Columbia's Center for Teaching and Learning, n.d.).

## Regulation

Generally used to describe a person's ability to effectively manage and respond to an emotional experience (Cornell Research Program on Self Injury and Recovery, n.d.).

## Relationship Skills

Relationship skills are the abilities to establish and maintain healthy and supportive relationships and to effectively navigate settings with diverse individuals and groups. This includes the capacities to communicate clearly, listen actively, cooperate, work collaboratively to problem solve and negotiate conflict constructively, navigate settings with differing social and cultural demands and opportunities, provide leadership, and seek or offer help when needed (CASEL, n.d.).

## Responsible Decision-Making

The abilities to make caring and constructive choices about personal behavior and social interactions across diverse situations is known as responsible decision-making. This includes the capacity to consider ethical standards and safety concerns, and to evaluate the benefits and consequences of various actions for personal, social, and collective well-being (CASEL, n.d.).

## Self-Awareness

Self-awareness centers around the ability to understand one's own emotions, thoughts, and values and how they influence behavior across contexts. This includes the capacity to recognize one's strengths and limitations with a well-grounded sense of confidence and purpose (CASEL, n.d.).

## Self-Management

Self-management is the ability to manage one's emotions, thoughts, and behaviors effectively in different situations and to achieve goals and aspirations. This includes the capacity to delay gratification, manage stress, and feel motivation and agency to accomplish personal and collective goals (CASEL, n.d.).

## Social-Awareness

The ability to understand the perspectives of and empathize with others, including those from diverse backgrounds, cultures, and contexts is known as self-awareness. This includes the capacity to feel compassion for others, understand broader historical and social norms for behavior in different settings, and recognize family, school, and community resources and supports (CASEL, n.d.)