

Section 3 – Planning Resources

Overview

Science is not just a body of knowledge that reflects current understanding of the world; it is also a set of practices used to establish, extend, and refine that knowledge¹. Our core science instruction must also allow for students to develop their science and engineering practices over time in addition to disciplinary core ideas. We know that children enter kindergarten with a surprisingly complex way of thinking about the world². We know that students need sustained opportunities to work with and develop the underlying ideas and to appreciate those ideas' interconnections over a period of years rather than weeks or months. We know that in order for students to develop a sustained attraction to science and for them to appreciate the many ways in which it is pertinent to their daily lives, classroom learning experiences in science need to connect with their own interests and experiences. To this end, the National Research Council lays out a three-dimensional framework that is foundational to the development of the *Next Generation Science Standards (NGSS)*.

Dimension 1 describes the scientific and engineering practices (SEP). Dimension 2 describes the crosscutting concepts (CCC). Dimension 3 describes the core ideas (DCI) in the science disciplines and the relationships among science, engineering, and technology. All three of these dimensions must be interwoven in curriculum, instruction, and assessment.

Getting Started with Using the Standards

The first step of any teacher in planning instruction is to deeply understand the end result that is required. The standards section of the NMIS Science document is placed first so that teachers have quick access to these requirements. The *NGSS* describe the essential learning goals and how those goals will be assessed at each grade level or band.

It is generally accepted that planning for instruction begins with the selection of the endpoint, or desired results of the instruction, and working backward through an instructional sequence to the beginning knowledge students have coming into the instruction. The description of such a process has been documented by Wiggins and McTighe in *Understanding by Design* (1998).

For the purpose of the NMIS Science document, a process for moving from the New Mexico STEM Ready! Science Standards to classroom instruction³ should minimally include the following³:

- Read the performance expectation, clarification statement, and assessment boundary.
- Read the disciplinary core idea in the foundation box.
 - Read the applicable disciplinary core idea essay in *A Framework for K–12 Science Education*, located in chapters 5, 6, 7, and 8. As you read, consider the following questions:
 - What are some commonly held student ideas about this topic?
 - How could instruction build on helpful ideas and confront troublesome

¹ National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

² National Research Council. (2007). *Taking Science to School: Learning and Teaching Science in Grades K-8*. Committee on Science Learning, Kindergarten through Eighth Grade. R.A. Duschl, H.A. Schweingruber, and A.W. Shouse (Eds.). Board of Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

³ Bybee, Rodger W. (2013) *Translating the NGSS for Classroom Instruction*.

- ideas?
 - What prior ideas or concepts do students need to learn to understand this core idea?
 - What level of abstractness is expected of students?
 - What are some phenomena and experiences that could provide observational or experimental evidence that the DCI is an accurate description of the natural world?
 - What representations or media would be helpful for students to use in making sense of the core idea?
- Read the science and engineering practices associated with the performance expectation.
 - Read the applicable SEP essay in *A Framework for K–12 Science Education* located in chapter 3, consider the following questions:
 - While the PE describes one SEP to be used, others will be needed in the instructional sequence, which ones and in what order will you use them?
 - How will each SEP be used to develop an understanding of the DCI?
 - What practices could students engage in to explore phenomena?
- Read the crosscutting concept associated with the performance expectation.
 - Read the applicable CCC essay in *A Framework for K–12 Science Education* located in chapter 4, consider the following questions:
 - How will the CCC indicated in the PE support the understanding of the core idea?
 - Are there other CCC that could also support learning the core idea?
- Read the connections box
 - When reading the connections to other DCI at this grade level that are relevant to the standard, consider the following question:
 - How can instruction be designed so that students note the connections between the core ideas?
 - When reading the articulation of DCI across grade levels that are relevant to the standard, consider the following questions:
 - Examine the standard at earlier grade levels, do they provide an adequate prior knowledge for the core ideas in the standard being reviewed?
 - Examine the standard at later grade levels, does the standard at this level provide adequate prior knowledge for the core ideas in the later standards?
 - When reading the CCSS in mathematics and English language arts (ELA), consider the following questions:
 - Should students have achieved these mathematics and ELA standards to engage in the learning of science, or could they be learned together?
 - In what ways do the referenced mathematics and ELA standards help clarify the science performance expectations?
 - Can any of the science core ideas be included as examples in the mathematics or ELA instruction?
- Create one or more descriptions of the desired results or learning goals for the instruction integrating the three dimensions in the foundation box.
- Determine the acceptable evidence for the assessment of the desired results.
- Create the learning sequence
 - The NMIS Science document includes aspects of instruction considerations that can be used to assist with this process.

- Create or utilize the summative assessment and check its alignment with the performance expectation.

Engaging in the Science and Engineering Practices

Students provided sustained opportunities to engage in the practices of science and engineering better understand how knowledge develops and provides them an appreciation of the diverse strategies used to investigate, model, and explain the world. The practices for K–12 science classrooms are:

1. Asking questions (science) and defining problems (engineering)
 - a. Science asks:
 - i. What exists and what happens?
 - ii. Why does it happen?
 - iii. How does one know?
 - b. Engineering asks:
 - i. What can be done to address a particular human need or want?
 - ii. How can the need be better specified?
 - iii. What tools or technologies are available, or could be developed, for addressing this need?
 - c. Both ask:
 - i. How does one communicate about phenomena, evidence, explanations, and design solutions?
2. Developing and using models
 - a. Mental models: functional, used for thinking, making predictions, and making sense of experiences.
 - b. Conceptual models: allow scientists and engineers to better visualize and understand phenomena and problems.
 - c. Are used to represent current understanding of a system (or parts of a system) under study, to aid in the development of questions or explanations, and to communicate ideas to others.
3. Planning and carrying out investigations
 - a. Used to systematically describe the world and to develop and test theories and explanations of how the world works.
4. Analyzing and interpreting data
 - a. Once collected, data are presented in a form that can reveal any patterns and relationships and that allows results to be communicated to others.
5. Using mathematics and computational thinking
 - a. Enables the numerical representation of variables, the symbolic representation of relationships between physical entities, and the prediction of outcomes.
6. Constructing explanations (science) and designing solutions (engineering)
 - a. Explanations are accounts that link scientific theory with specific observations or phenomena.
 - b. Engineering solutions must include specifying constraints, developing a design plan, producing and testing models/prototypes, selecting among alternative design features to optimize achievement, and refining design ideas based on prototype performance.
7. Engaging in argument from evidence
 - a. Scientists and engineers use reasoning and argumentation to make their case

concerning new theories, proposed explanations, novel solutions, and/or fresh interpretations of old data.

8. Obtaining, evaluating, and communicating information
 - a. Being literate in science and engineering requires the ability to read and understand their literature. Science and engineering are ways of knowing that are represented and communicated by words, diagrams, charts, graphs, images, symbols, and mathematics.

STEM Teaching Tools develop briefs to assist STEM teachers with issues that arise in the teaching of STEM. Here are some briefs that address scientific practices. All of these can be found at www.stemteachingtools.org/tools

Why focus on science and engineering practices – and not “inquiry?” Why is “the scientific method” mistaken? - STEM Teaching Tool #32

For decades science education has engaged students in a version of science inquiry that reduces the investigation of the natural world to a fixed, linear set of steps—sometimes devoid of a deep focus on learning and applying science concepts. Rigid representations of a single "scientific method" do not accurately reflect the complex thinking or work of scientists. The new vision calls for engaging students in multifaceted science and engineering practices in more complex, relevant, and authentic ways as they conduct investigations.

Practices should not stand alone: how to sequence practices in a cascade to support student investigations – STEM Teaching Tool #3

Science and engineering practices should strongly shape instruction—and be integrated with disciplinary core ideas and cross-cutting concepts. Some people might treat the practices as “stand alone” activities to engage students, but research shows that it is more effective to think about designing instruction as a cascade of practices. Practices should be sequenced and intertwined in different ways to support students in unfolding investigations.

What is meant by engaging youth in scientific modeling? - STEM Teaching Tool #8

A model is a representation of an idea or phenomenon that otherwise may be difficult to understand, depict, or directly observe. Models are integral to the practice of science and are used across many disciplines in a variety of ways. Scientists develop, test, refine, and use models in their research and to communicate their findings. Helping students develop and test models supports their learning and helps them understand important aspects of how science and engineering work.

Beyond a written C-E-R: supporting classroom argumentative talk about investigations – STEM Teaching Tool #17

Argumentation, a central scientific practice, relies on the coordination of claims, evidence, and reasoning (C-E-R). C-E-R scaffolds can help students compose a written argument for an investigation. However, there are additional important dimensions to argumentation beyond individually written claims. Classroom discussions that require students to make evidence-based claims and collectively build understanding also reflect argumentation. Several types of discussions can be used and can help build a supportive classroom culture.

Why should students learn to plan and carry out investigations in science and engineering? - STEM Teaching Tool #19

The NRC Framework for K-12 Science Education specifies eight science and engineering practices to be incorporated into science education from kindergarten through twelfth grade. One of these is planning and carrying out investigations. Although many existing instructional models and curricula involve engaging students in planned investigations, this tool will help you think about ways you can promote student agency by having them plan and conduct science investigations.

How can assessments be designed to engage students in the range of science and engineering practices? - STEM Teaching Tool #26

The new vision for K-12 science education calls for engaging students in three-dimensional science learning. This approach requires us to figure out new ways to assess student learning across these multiple dimensions—including the eight science and engineering practices. But there aren't many assessment tasks that require students to apply their understanding of core ideas using practices. In this tool, we describe how to use "task formats" to guide the development of such items. The formats can also spark ideas for designing classroom instruction.

Integrating science practices into assessment tasks - STEM Teaching Tool #30

This detailed and flexible tool suggests activity formats to help teachers create three-dimensional assessments based on real-world science and engineering practices. In response to this felt need being expressed among educators, researchers at the Research + Practice Collaboratory has developed a series of "task format" tables, which suggest different possible templates for student activities that integrate real-world science and engineering practices with disciplinary core ideas. This tool also combines two of the Research + Practice Collaboratory's major focuses: formative assessment and engaging learners in STEM practices. This tool offers between four and eight possible task formats for each of the science and engineering practices listed in the Next Generation Science Standards. It can be a great way for educators to brainstorm new activities or to adapt their existing lesson plans to this new three-dimensional vision.

Engaging students in computational design during science investigations - STEM Teaching Tool #56

Inquiry in science has become increasingly computational over the past several decades. The broad availability of computational devices, sensor networks, visualizations, networking infrastructure, and programming have revolutionized the way science and engineering investigations are carried out. Computational thinking practices enable unique modes of scientific inquiry that allow scientists to create models and simulations to generate data, and to understand and predict complex phenomena. K-12 science classrooms are natural contexts in which students can engage in computational thinking practices during their investigations.

Designing 'productive uncertainty' into investigations to support meaningful engagement in science practices - STEM Teaching Tool #60

We want students to engage from the earliest ages in science and engineering practices with sincere curiosity and purpose. Science investigations can be viewed as "working through uncertainty." However, 3D instructional materials often try to support engagement in science practices by making them very explicit and scaffolding the process to make it easy to accomplish—arguably, too easy. An alternative approach that emphasizes productive uncertainty focuses on how uncertainty might be

strategically built into learning environments so that students establish a need for the practices and experience them as meaningful ways of developing understanding.

Using science investigations to develop caring practices for social-ecological systems – STEM Teaching Tool #61

Science investigations are a powerful way to foster caring practices for social-ecological systems. It encourages building relationships between learners and local ecosystems, highlighting the importance of multispecies justice and interconnectedness. The approach integrates diverse cultural perspectives, promotes empathy and ethical considerations, and supports transdisciplinary inquiry-based learning. Educators are urged to create opportunities for students to engage with their environment through observation, inquiry, and actions that benefit both humans and more-than-humans.

How to integrate the argumentation from evidence practice into engineering design projects – STEM Teaching Tool #63

The practice brief explains how to integrate argumentation from evidence into engineering design projects. It highlights the importance of teaching students to support engineering claims with specific evidence and reasoning, aligning with scientific practices. This process involves evaluating design merits, using diverse forms of evidence, and fostering collaborative problem-solving. The brief also addresses equity, suggesting accommodations to ensure all students can engage in argumentation, and provides actionable strategies for educators to create robust, argument-driven engineering projects.

How can arguing from evidence support sensemaking in elementary science? – STEM Teaching Tool #72

The practice brief focuses on the importance of integrating argumentation from evidence into elementary science education to support sensemaking. It highlights the need for students to engage in evidence-based discussions, propose and critique claims, and collaboratively build explanations for phenomena. The brief emphasizes creating equitable learning environments where diverse perspectives are valued and students develop skills in scientific reasoning. It also provides practical strategies for educators to foster a classroom culture that supports inquiry, curiosity, and the development of critical thinking skills.

Crosscutting concepts

A Framework for K-12 Science Education identifies seven concepts that bridge disciplinary boundaries. These concepts provide students with an organizational framework for connecting knowledge from the various disciplines into a coherent and scientifically based view of the world. These crosscutting concepts are:

1. Patterns – guide organization and classification, prompt questions about relationships and the factors that influence them.
2. Cause and effect: mechanisms and explanations – a major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across contexts and used to predict and explain events in new contexts.
3. Scale, proportion, and quantity – in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.
4. Systems and system models – Defining systems under study provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. Energy and matter: flows, cycles, and conservation – Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems’ possibilities and limitations.
6. Structure and function – The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
7. Stability and change – conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

STEM Teaching Tools develop briefs to assist STEM teachers with issues that arise in the teaching of STEM. Here are some briefs that address scientific practices. All of these can be found at www.stemteachingtools.org/tools

Prompts for integrating crosscutting concepts into assessment and instruction – STEM Teaching Tool #41

This set of prompts is intended to help teachers elicit student understanding of crosscutting concepts in the context of investigating phenomena or solving problems. These prompts should be used as part of a multi-component extended task. These prompts were developed using the *Framework for K-12 Science Education* and [Appendix G](#) of the Next Generation Science Standards, along with relevant learning sciences research.

The planning and implementation of instruction in your classroom should allow your students multiple and sustained opportunities to learn disciplinary core ideas through the science and engineering practices, as well as using appropriate crosscutting concepts as lenses to understand the disciplinary core idea and its relationship to other core ideas.

Planning Guidance for Culturally and Linguistically Responsive Instruction

“Equity in science education requires that all students are provided with equitable opportunities to learn science and become engaged in science and engineering practices; with access to quality space, equipment, and teachers to support and motivate that learning and engagement; and adequate time spent on science. In addition, the issue of connecting to students’ interests and experiences is particularly important for broadening participation in science.”¹

In order to ensure our students from marginalized cultures and languages view themselves as confident and competent learners and doers of science within and outside of the classroom, educators must intentionally plan ways to counteract the negative or missing images and representations that exist in our curricular resources. The guiding questions below support the design of lessons that validate, affirm, build, and bridge home and school culture for learners of science:

Validate/Affirm: How can you design your classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the science abilities of students of marginalized cultures and languages?

Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students’ home culture and language and the culture and language of school science to support students in creating identities as capable scientists that can use science within school and society?

STEM Teaching Tools highlight ways of working on specific issues that arise during STEM teaching. Here are some tools that have been created to guide STEM instruction around the concept of culturally and linguistically responsive instruction. All of these can be found at www.stemteachingtools.org/tools.

How can we promote equity in science education? - STEM Teaching Tool #15

Equity should be prioritized as a central component in all educational improvement efforts. All students can and should learn complex science. However, achieving equity and social justice in science education is an ongoing challenge. Students from non-dominant communities often face "opportunity gaps" in their educational experience. Inclusive approaches to science instruction can reposition youth as meaningful participants in science learning and recognize their science-related assets and those of their communities.

Building an equitable learning community in your science classroom – STEM Teaching Tool #54

Equitable classroom communities foster trusting and caring relationships. They make cultural norms explicit in order to reduce the risk of social injuries associated with learning together. Teachers are responsible for disrupting problematic practices and developing science classroom communities that welcome all students into safe, extended science learning opportunities. However, this is tricky work. This tool describes a range of classroom activities designed to cultivate communities that open up opportunities for all students to learn.

How can you advance equity and justice through science teaching? - STEM Teaching Tool #71

Inequities are built into the systems of science education such that “students of color, students who speak first languages other than English, and students from low-income communities... have had limited access to high-quality, meaningful opportunities to learn science.” Intersecting equity projects can guide the teaching and learning of science towards social justice. Science educators who engage in these projects help advance Indigenous self-determination (details) and racial justice by confronting the consequences of legacies of injustice and promoting liberatory approaches to education.

Why you should stop pre-teaching science vocabulary and focus on students developing conceptual meeting first – STEM Teaching Tool #66

In New Mexico, and in the *Framework for K–12 Science Education*, we promote an inclusive educational environment for all students. Students should first develop conceptual understanding through sensemaking and observation. It is important to leverage students' home languages and diverse communication methods to enhance learning and participation, especially for multilingual and historically marginalized students. The approach promotes linguistic equity, encouraging environments where all forms of communication are valued, and suggests practical strategies for educators to integrate this methodology into their teaching practices.

Focusing science and engineering learning on justice-centered phenomena across PK-12 – STEM Teaching Tool #67

In the Framework vision for science education, students engage in active investigations to make sense of natural phenomena and analyze and build solutions to problems. Basing these investigations on justice-centered phenomena can be a powerful and rightful way to support science and engineering learning. Justice-centered investigations can open up important opportunities for students to engage in projects that support equity for communities and to see how the application of science and engineering are fundamentally entwined with political and ethical questions, dimensions, and decisions.

Teaching STEM in ways that respect and build upon indigenous peoples' rights – STEM Teaching Tool #10

Indigenous ways of knowing are sometimes thought to be in opposition to and detrimental to the learning of Western Science or STEM. Consequently, indigenous ways of knowing are rarely engaged to support learning. If STEM learning is to be meaningful and transformative for Indigenous youth, respecting Indigenous peoples' rights and related critical issues, including Indigenous STEM, settler-colonialism, and decolonization, must be understood and explicitly addressed in Indigenous youths' informal and formal STEM learning experiences.

How can formative assessment support culturally responsive argumentation in a classroom community? - STEM Teaching Tool #25

Argumentation has long been seen as an important practice in science and thus in science

education. Formative assessment can be used to help students value the contributions and perspectives of others as they engage in argumentation to make sense of natural phenomena. Educators can use these strategies to help foster argumentation that is culturally responsive, meaning it draws from and respects students' cultural resources, backgrounds, and personal experiences. Culturally responsive formative assessment happens within a community of learners where the teacher has cultivated explicit norms for increasing student-centered discourse, making decisions for their own purposes through democratic processes, and using clear guidelines for maintaining mutual respect.

Engaging English learners in science and engineering practices – STEM Teaching Tool #27

Routinely engaging all students in the practices of science and engineering is a crucial fixture of the new vision for K-12 science education. The practices can be seen as a barrier to participation for English Learners (ELs), or they can be viewed as an opportunity to provide rich instruction that builds science-related competencies and identities. Certain elements of the practices and related instructional approaches can be beneficial for students learning science while also learning the language of instruction.

How can I promote equitable sensemaking by setting expectations for multiple perspectives? - STEM Teaching Tool #47

In a phenomena-focused, 3D approach to science learning, students use science practices to consider each other's ideas based on available interpretations and evidence. To promote deep and equitable learning, plan purposefully to ensure that the various perspectives that students bring to making sense of phenomena are solicited, clarified, and considered. It is important to support students as they develop a shared understanding of the different perspectives in the group.

Supporting observations, wonderings, systems thinking & "Should We" deliberations through Learning in Places - STEM Teaching Tool #82

The practice brief emphasizes the importance of integrating observations, wonderings, and systems thinking in science education to support socioecological understanding and ethical decision-making. It advocates for field-based practices where learners and families engage with their environments, ask meaningful questions, and consider ethical implications. This approach values diverse cultural perspectives and aims to create equitable, place-based learning experiences that connect science with community well-being.

Identifying local environmental justice, phenomena for science and engineering investigations - STEM Teaching Tool #87

The practice brief highlights the need for science and engineering education to focus on local environmental justice (EJ) issues. It encourages engaging students with personally relevant EJ phenomena to develop a deeper understanding of these issues and to promote civic action. By investigating local EJ concerns, students can explore causes, impacts, and diverse perspectives, fostering individual and collective agency. The brief also emphasizes the importance of community-based learning and the integration of interdisciplinary approaches to address EJ and support frontline communities.

UDL: Action and Expression

- Provide independent think time before students engage with others or responses are discussed.
- Ensure students have enough time to complete tasks and provide extra time if needed.
- Provide access to pre-cut materials, assistive tools, devices, and software.
- Offer flexibility and choice with the ways students demonstrate and communicate their understanding.
- Invite students to explain their thinking verbally or nonverbally with manipulatives, drawings, diagrams.
- Support fluency with graduated levels of support or practice.
- Apply and gradually release scaffolds to support independent learning.
- Support discourse with sentence frames or visible language displays.
- Support the development of organizational skills in problem-solving with access to templates, rubrics, and checklists.
- Post visible goals, objectives, and schedules.
- Provide opportunities for self-assessment and enable students to monitor their own progress.

Throughout the curriculum, students should be invited to share both their understanding and their reasoning about mathematical ideas with others. Offer flexibility and choice with the ways students demonstrate and communicate their understanding and invite students to explain their thinking verbally or nonverbally with manipulatives, drawings, diagrams. Provide independent think time before students engage with others or responses are discussed and support discourse with sentence frames or visible language displays. Ensure students have enough time to complete tasks and provide extra time if needed, as well as pre-cut materials, assistive tools, devices, and software. Support fluency with graduated levels of support or practice, applying and gradually releasing scaffolds to support independent learning. Support the development of organizational skills in problem-solving with access to templates, rubrics, and checklists and provide opportunities for self-assessment and enable students to monitor their own progress. Post visible goals, objectives, and schedules.

UDL: Engagement

- Provide choice by inviting students to decide which problem to start with, select a subset of problems to complete, which strategy to use, the order they complete a task, etc.
- Provide access to a variety of tools or materials.
- Leverage curiosity and students' existing interests and invite students to name connections to their own lived experiences.
- Use visible timers and alerts to prepare for transitions.
- Chunk tasks into more manageable parts and check in with students to provide feedback and encouragement after each chunk.
- Differentiate the degree of difficulty or complexity by starting with accessible values.
- Periodically revisit community norms and provide group feedback that encourages collaboration and community.
- Provide ongoing feedback that helps students maintain sustained effort and persistence during a task.
- Encourage self-reflection and identification of personal goals.
- Provide access to tools and strategies designed to help students self-motivate and become more independent.

Students' attitudes, interests, and values help to determine the ways in which they are most engaged and motivated to learn. Provide access to a variety of tools, strategies, and materials designed to help students self-motivate and become more independent. Leverage curiosity and students' existing interests and invite students to name connections to their own lived experiences. Provide choice by inviting students to decide which problem to start with, select a subset of problems to complete, which strategy to use, the order they complete a task, etc. Use visible timers and alerts to prepare for transitions, and chunk tasks into more manageable parts and check in with students to provide feedback and encouragement after each chunk. Differentiate the degree of difficulty or complexity by starting with accessible values. Periodically revisit community norms and provide group feedback that encourages collaboration and community. Provide ongoing feedback that helps students maintain sustained effort and persistence during a task and encourage self-reflection and identification of personal goals.

UDL: Representation

- Present content using multiple modalities.
- Annotate displays with specific language, different colors, shading, arrows, labels, notes, diagrams, or drawings.
- Provide appropriate reading accommodations.
- Support use of vocabulary, mathematical notation, and symbols with charts, pictures, diagrams, and tables.
- Highlight connections between representations to make patterns and properties explicit.
- Present problems or contexts in multiple ways, using diagrams, drawings, pictures, media, tables, graphs, and other mathematical representations.
- Use translations, descriptions, movement, and images to support unfamiliar words or phrases.
- Activate or supply background knowledge to build connections to prior understandings and experiences.
- Provide access to blank or partially-completed outlines, graphic organizers, or representations, to emphasize key ideas and relationships.
- Maximize transfer and generalization by naming connections to previous examples, inviting students to identify important details or features to remember

Teachers can reduce barriers and leverage students' individual strengths by presenting content using multiple modalities and annotating displays with specific language, different colors, shading, arrows, labels, notes, diagrams, drawings, etc. Support the use of vocabulary, mathematical notation, and symbols with charts, pictures, diagrams, and tables, and use translations, descriptions, movement, and images to support unfamiliar words or phrases. Present problems or contexts in multiple ways, using diagrams, drawings, pictures, media, tables, graphs, and other mathematical representations, and highlight connections between different mathematical representations to make patterns and properties explicit. Activate or supply background knowledge to build connections to prior understandings and experiences and maximize transfer and generalization by naming connections to previous examples, inviting students to identify important details or features to remember. Provide reading accommodations as needed, as well as blank or partially-completed outlines, graphic organizers, or representations, to emphasize key ideas and relationships.