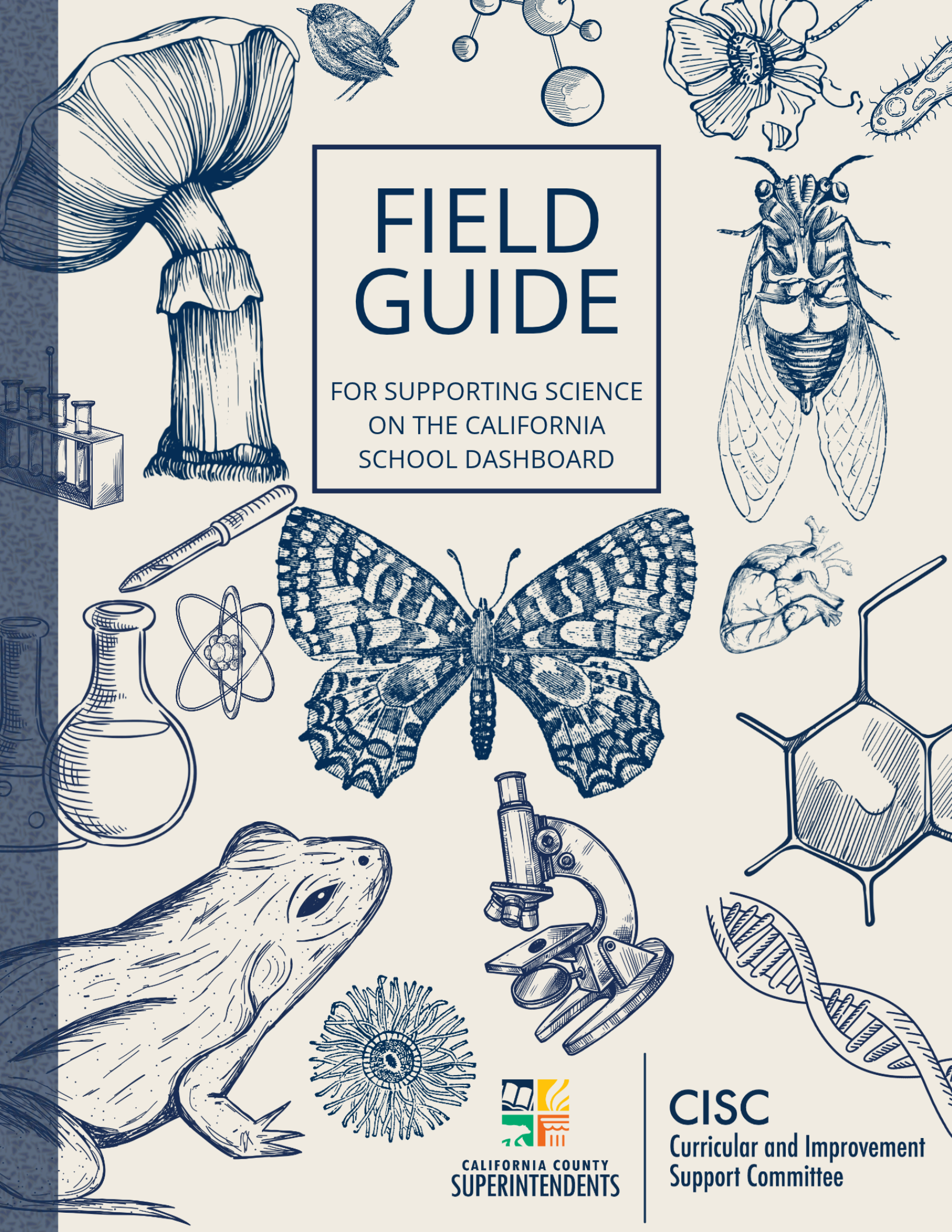


FIELD GUIDE

FOR SUPPORTING SCIENCE ON THE CALIFORNIA SCHOOL DASHBOARD

CALIFORNIA COUNTY SUPERINTENDENTS

CISC
Curricular and Improvement Support Committee

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FOREWORD

On behalf of the California County Superintendents, we are pleased to introduce the 2026 *Field Guide for Supporting Science on the California School Dashboard*, a resource designed to support educators and educational leaders across California in strengthening science teaching, learning, and equity.

The *Field Guide for Supporting Science on the California School Dashboard* provides tools, examples, reflection opportunities, and guidance to help educational leaders build shared understanding, identify strengths and areas of need, engage in inquiry cycles around multiple sources of data, and chart next steps for improving science teaching and learning. The four sections of the guide move from understanding California's science assessment system, to analyzing and interpreting data, to strengthening science within local systems, and ultimately to supporting instruction and assessment aligned to the Next Generation Science Standards (NGSS) and the California Science Framework.

The California County Superintendents is an organization consisting of the county superintendents of schools from the 58 California counties working in partnership with the California Department of Education. The Curricular and Improvement Support Committee (CISC) is a subcommittee of the California County Superintendents and consists of county office leaders focusing on curriculum, instruction, assessment, continuous improvement, and professional learning opportunities. The California County Superintendents are pleased to provide this field guide as a resource for California educators and leaders.

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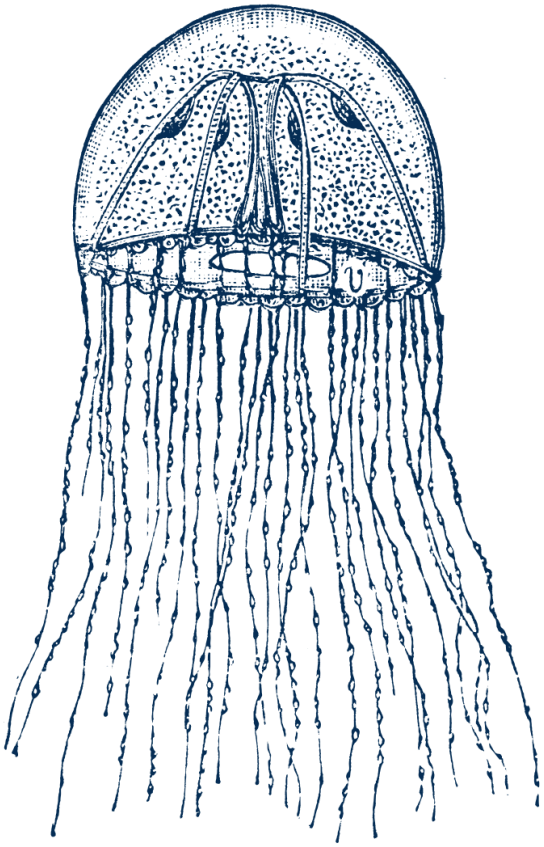
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This guide supports a wide range of educational partners:

- LEAs and Site Administrators: To embed science in Local Control and Accountability Plans (LCAPs) and instructional systems
- County Office Support Staff: To guide implementation and professional learning
- Instructional Coaches and Teachers on Special Assignment (TOSAs): To lead co-planning and classroom support
- Teachers and Teacher Leaders: To implement NGSS-aligned curriculum and use assessment data to continuously improve the implementation of instructional practices outlined in the Science Framework

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INTRODUCTION

This Field Guide for Supporting Science on the Dashboard (field guide) is designed to help educators and leaders across California strengthen science teaching, learning, and equity in response to the Science Indicator on the California School Dashboard. As science becomes a full state indicator, local educational agencies (LEAs) have both an opportunity and a responsibility to intentionally support science learning across their systems.

The Science Indicator provides meaningful information about student progress and creates opportunities for schools, districts, and county offices of education to engage in shared inquiry and collective action. Grounded in the vision of the California Next Generation Science Standards (CA NGSS), this field guide offers tools, examples, and guidance to help leaders build understanding, examine system strengths and needs, engage in data-informed inquiry cycles, and identify meaningful next steps to improve science learning and outcomes for every student.

There are four sections in this field guide:

- **Section 1: Understanding California's Science Assessment System** - Understanding how the Science Indicator works and why it matters
- **Section 2: Analyzing and Interpreting Science Data** - Support, tools, and processes for how to analyze and act on CAST data, local systems data, and classroom assessment data
- **Section 3: Strengthening Science within Your System** - Guidance for how to integrate science into local planning and accountability systems
- **Section 4: Planning and Supporting Instruction & Assessment** - Guidance for how to support NGSS-aligned instruction and assessment

Why This Guide? Why Now?

The visibility of the Science Indicator on the Dashboard supports a vision for science learning in and across all levels of the educational system. The status of Science on the California School Dashboard as a full state indicator signals a commitment to the achievement of this vision for science.

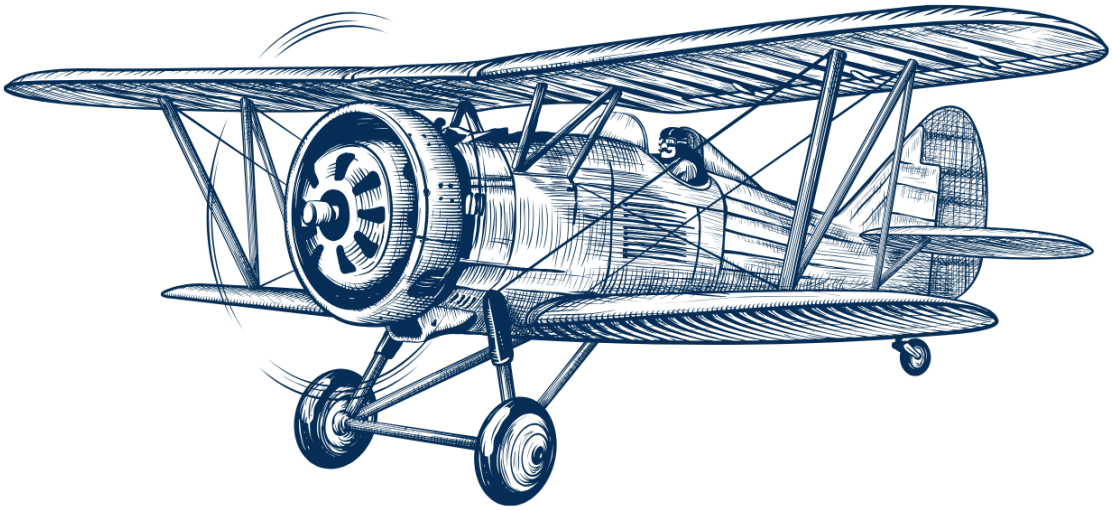
This field guide supports:

- Instructional improvement
- Equity and access
- Data-informed planning
- Shared understanding across roles

Reflection and Call to Action

Through your role in your educational setting or context:

- What sections of this field guide will be most helpful to you?
- How might this field guide help build shared ownership for science improvement?
- What wonders or questions come to mind about this field guide?



SECTION 1: Understanding California's Science Assessment System

1.1 Introduction

Section 1 provides foundational knowledge of California's science assessment system and its role within the state's broader accountability and continuous improvement efforts. It explores the history of the California School Dashboard (Dashboard), including the emergence of Science scores as an achievement indicator, and examines the implications of these policy decisions on Local Educational Agencies (LEAs).

Guiding Principles and Purpose

The Dashboard is grounded in a key belief that school quality goes beyond test scores. It was designed to:

- Provide a holistic view of student learning, engagement, and school conditions.
- Advance equity by spotlighting gaps in outcomes across student groups.
- Support local decision-making by offering actionable data that drives improvement.

In 2022, the State Board of Education (SBE) formally adopted the California School Dashboard Principles to guide future changes and maintain alignment with the state's educational priorities. These principles shape how indicators, including the Science Indicator, are developed, interpreted, and refined.

Dashboard data should be understood as one part of California's larger system of assessment and accountability. Within a balanced assessment system, educators use multiple sources of evidence collected at different intervals and for different purposes. Classroom observations, student conversations, student work, curriculum-embedded assessments, interim measures, and annual statewide assessments each offer distinct information about student learning. When considered together, these measures provide a more complete picture of students' strengths, progress, opportunities to learn, and areas requiring additional support.

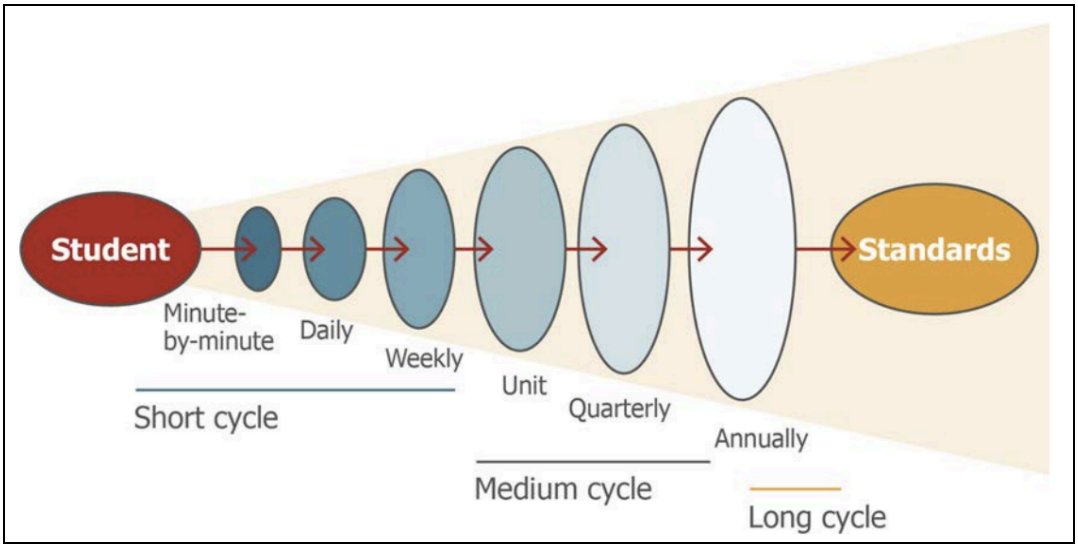


Figure 1.1: California system of assessments continuum. (Adapted from Herman and Heritage 2007.)[1]

The California Science Test (CAST) is the annual statewide assessment within this broader system. Aligned with the California Next Generation Science Standards (CA NGSS), the CAST provides important information about student performance at the school, local educational agency, and state levels. CAST and Dashboard results are most meaningful when interpreted alongside classroom evidence, local assessment data, student experiences, and information about access to high-quality science learning. No single assessment provides a complete picture; collectively, these sources of evidence help educators and communities identify strengths, examine disparities, allocate resources, and determine appropriate next steps.

Science learning is essential in every grade. The three-dimensions of the CA NGSS, which include 42 Disciplinary Core Ideas[2] (DCIs), 8 Science and Engineering Practices[3] (SEPs), and 7 Crosscutting Concepts[4] (CCCs), are intentionally designed to grow in complexity across the K–2, 3–5, middle school, and high school grade bands. The CAST not only assesses students on science content (DCI), but also their ability to engage in scientific skills (SEPs) and make connections across concepts (CCCs). Rather than testing content knowledge in isolation, the CAST asks students to apply that knowledge by analyzing data, constructing explanations, evaluating evidence, and reasoning across disciplines the way scientists and engineers actually do. Additional information about the grade span progressions of the three-dimensions is available in Appendix 1 of the California Science Framework[5].

[1] https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter9.pdf
[2] https://www.sdcoe.net/ngss/dimensions-of-the-ngss/disciplinary-core-ideas
[3] https://www.sdcoe.net/ngss/dimensions-of-the-ngss/scientific-and-engineering-practices
[4] https://www.sdcoe.net/ngss/dimensions-of-the-ngss/crosscutting-concepts
[5] https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf



Science and Engineering Practices (SEPs)	Behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems.
Disciplinary Core Ideas (DCIs)	Key organizing concepts, problem solving tools, or underlying principles of a discipline.
Crosscutting Concepts (CCCs)	Underlying themes that have value in all disciplines of science.

Figure 1.2: The CA NGSS Logo Illustrates the Three Dimensions of Science. (CA NGSS Framework, Ch 1[6].)

This section introduces the structure and purpose of the CAST, explains how results are communicated through Achievement Level Descriptors (ALDs), and describes how CAST performance contributes to the Dashboard's Science Indicator. Understanding how these elements fit within the larger assessment and accountability system can help site leaders, district administrators, educators, and support providers interpret science data responsibly and use it to guide equitable planning, professional learning, resource allocation, and support for all students.

By the end of this section, you should be able to:

1. Explain how science assessment fits into California's accountability and continuous improvement system.
2. Describe the purpose and structure of the California Science Test (CAST) and the Science Indicator.
3. Use this understanding to guide local planning, inform professional learning, and support student groups.

1.2 Key Concepts & Terms

Here are a few foundational terms that will help you navigate this section and the science data system overall.

- **California School Dashboard:** The state's primary accountability system, launched in 2017, evaluates school and district performance using multiple measures—such

[6] https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter1.pdf

as academic achievement, suspension rates, and college/career readiness. It presents this data using a color-coded system and emphasizes equity by reporting performance by student group.

- **California Science Test (CAST)**: A statewide summative assessment aligned to the California Next Generation Science Standards (CA NGSS), administered in grades 5, 8, and once in high school. CAST results are used to populate the Science Indicator on the Dashboard.
- **Achievement Level Descriptors (ALDs)**: Descriptions of student performance at each of four achievement levels on the CAST: Advanced, Proficient, Developing, and Minimal. ALDs help interpret what students know and can do based on their test scores.
- **Science Points**: A 0–100 scale used to report CAST results on the California School Dashboard. This modified scoring system, specific to science, differs from the "Distance from Proficiency" (DFP) method used in English Language Arts (ELA) and Mathematics, better aligning with the structure of the science assessment.

1.3 History of the California School Dashboard

LAUNCH AND EARLY DEVELOPMENT

2017: Launch of the California School Dashboard

In March 2017, the California School Dashboard officially replaced the Academic Performance Index (API), ushering in a new era of multidimensional school and district evaluation. Designed to support local continuous improvement, the Dashboard introduced:

- **Multiple measures**, including academic performance, graduation rates, suspension rates, English learner progress, and college/career readiness.
- **A color-coded rating system** using five performance levels—from Red to Blue—based on both current performance ("Status") and the difference from the

previous year ("Change"). Together, these measures provide a clearer picture of where schools and districts are progressing and where challenges persist.
- **An emphasis on equity** through data disaggregated by student group to help identify disparities in educational outcomes.
- **Greater transparency and access** through user-friendly, web-based reports for California schools and districts.

2018: Expansion of Dashboard Indicators

In 2018, the Dashboard expanded to include additional measures, such as Chronic Absenteeism and the English Learner Progress Indicator (ELPI). These additions provided a more comprehensive view of student outcomes and school performance.

DEVELOPMENT OF THE SCIENCE INDICATOR

2016–2023: Exploration and Planning

Between 2016 and 2023, the State Board of Education (SBE) explored the feasibility of incorporating science assessment results into California's accountability system. Implementation was delayed by several factors, including low assessment participation during the COVID-19 pandemic and revisions to the California Science Test (CAST) blueprint.

2023: Earlier Dashboard Release Timeline

Senate Bill 114 established an earlier annual release timeline for the Dashboard, giving local educational agencies (LEAs) more timely access to accountability data for planning and continuous improvement. Beginning in 2026, the Dashboard and statewide assessment results will be released together on October 15.[7]

2024: Science Appears on the Dashboard

The Science Indicator appeared on the Dashboard for the first time in 2024 as an information-only indicator without performance colors.

Rather than using the same Distance from Standard methodology applied to English language arts and mathematics, the Science Indicator reports results as **Science Points**.

[7] https://www.cde.ca.gov/ta/ac/cm/alignrelease.asp

This methodology rescales science assessment scores from zero to 100 to better reflect the structure of the CAST and the California Alternate Assessment for Science.

The California Department of Education's Science Indicator resources provide additional information about Science Points and how they are calculated.

The 2024 Dashboard also expanded student-group reporting to include Long-Term English Learners (LTELs). Beginning in 2025, however, LTELs were no longer treated as a qualifying student group for Differentiated Assistance under the criteria then in effect.

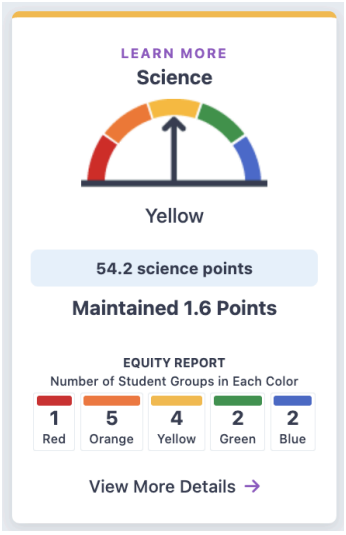
2025: Performance Colors Added

Following extensive planning and input from educational partners, the SBE approved key design elements for the Science Indicator, including:

- Status and Change cut scores
- A five-color performance grid ranging from Red to Blue
- Continued information-only use for the 2025 Dashboard

For the first time, the 2025 Dashboard displayed Science Indicator results using Status, Change, and performance colors. However, those results were not used to determine eligibility for Differentiated Assistance under the Local Control Funding Formula (LCFF) or support under the federal Every Student Succeeds Act (ESSA).[8]

Figure 1.3: Example of the California School Dashboard Science Indicator





[8] https://www.cde.ca.gov/ta/ac/cm/dashboardscience.asp

WHERE WE ARE NOW

2026: Science Becomes a Full State Indicator

At its July 2026 meeting, the SBE adopted Science as a full state indicator under **LCFF Priority 4: Student Achievement**, beginning with the 2026 Dashboard. The Science Indicator includes:

- Status and Change calculations
- A five-color performance grid ranging from Red to Blue
- Results disaggregated by student group

On October 15, 2026, the Dashboard and statewide assessment results were released on the same date, providing LEAs with a more timely and coherent picture of student performance.

The SBE also approved incorporating Science into Differentiated Assistance eligibility beginning in 2029. Until then, Science Indicator results will not be used to determine Differentiated Assistance eligibility. The SBE further directed the CDE to evaluate the inclusion of Science in ESSA support eligibility criteria following the 2026 identification cycle.[9]

WHAT THIS MEANS FOR LEAS

Science achievement is now a visible and formal part of how schools and LEAs are viewed by their communities, county offices of education, and the state. Although Science will not be incorporated into Differentiated Assistance eligibility until 2029, its designation as a full state indicator signals California's growing emphasis on science education.

Science results—particularly Red performance levels for an LEA or one or more student groups—should inform local needs assessments, goal setting, resource allocation, and improvement planning. Leadership teams involved in Local Control and Accountability Plan development and data analysis should understand how the Science Indicator is constructed and be prepared to discuss disparities in science outcomes.

The Dashboard is updated annually, enabling LEAs to monitor trends, evaluate strategies, and respond to changing student needs. Schools and districts can explore their results at

[9] https://publications.csba.org/california-school-news/august-2026/state-board-of-education-finalizes-new-assistance-criteria

the California School Dashboard[10] and consult the CDE's annually updated Dashboard Technical Guide for definitions, calculation methods, and business rules.

Section 2 (Analyzing and Interpreting Science Data) **of this field guide provides guidance for accessing, interpreting, and using Science Indicator data.**

1.4 Understanding the Structure and Scoring of the California Science Test (CAST)

STRUCTURE AND FORMAT OF THE CAST

The California Science Test (CAST) is California's statewide science assessment aligned with the California Next Generation Science Standards (CA NGSS). It is administered once in each grade span: in grade five, assessing the Performance Expectations (PEs) within the grades 3–5 span; in grade eight, assessing the grades 6–8 PEs; and once in high school, assessing the full range of high school PEs. (See figure 1.4 below.) CAST results contribute to the Science Indicator on the California School Dashboard and can help inform LEA planning, progress monitoring, and continuous improvement.

Figure 1.4 Summary of CAST Assessment Administration

	Elementary School	Middle School	High School
When?	5th Grade	8th Grade	10th, 11th, or 12th Grade
What standards are included?	All K-5 PEs*	All 6-8 PEs	All HS PEs
* Focus is on Grades 3-5 with foundational skills and concepts from K-2.			

Although CAST is first administered in grade five, preparation for the assessment—and, more importantly, for meaningful science learning—begins well before grade three. Each grade span builds upon the knowledge, skills, and ways of thinking developed in earlier

[10] https://www.caschooldashboard.org/

years, making science learning in grades K–2 essential. Early opportunities to explore phenomena, ask questions, conduct investigations, and make sense of the natural and designed world establish the foundation students need for increasingly complex science learning, success on the CAST, and future learning.

At the high school level, the CAST is structured to reflect the varied ways LEAs organize and sequence their science programs. It includes the full range of high school PEs and gives LEAs flexibility to administer the assessment to individual students in grades 10–12 when they are nearing the completion of their science program. The intent is not for every high school PE to be taught within a single course or grade. This design allows the CAST to reflect students' cumulative learning and their ability to integrate knowledge and practices developed across multiple science courses. As a result, the CAST evaluates Life Science, Physical Science (including Chemistry and Physics), and Earth and Space Science content regardless of whether students have taken coursework in those subjects, dispelling the common misconception that Physics is excluded because it is not a UC requirement.

The CAST uses a testing design called **partial matrix sampling**, which means that not all students see the same questions. Instead, items are pulled from multiple test forms in real time, allowing the assessment to cover more content without overburdening students. This adaptive approach helps gather system-level data efficiently.

The CAST includes **six testing segments** followed by a short **student survey**. While the assessment is untimed, most students complete it in about **two hours**. Elementary students may take slightly longer, while high schoolers may finish sooner. This flexible structure allows LEAs to schedule CAST administration in ways that meet the needs of different grade levels.

The CAST is organized into six segments, each designed to measure different aspects of student understanding. Here's a breakdown of what students encounter:

Segment Breakdown

- **Segments 1 & 2:** Discrete items (selected response, constructed response, table, fill-in, graphing, and so forth)[11]
    - Grade 5: 13 items each
    - Grade 8: 14 items each
    - High School: 16 items each

[11] https://www.cde.ca.gov/ta/tg/ai/cefcaaspp.asp

- **Segment 3:** Discrete items (13–16) *or* Performance Task (4–6 items)
- **Segments 4–6:** Performance Tasks (4–6 items per segment)
  Note: Performance tasks require students to engage in multi-step, NGSS-aligned reasoning—making them a rich source of insight into student thinking.
- **Student Survey:** At the end of the test:
  - Students in **grades 5 and 8** respond to three questions.
  - **High school** students respond to four questions.

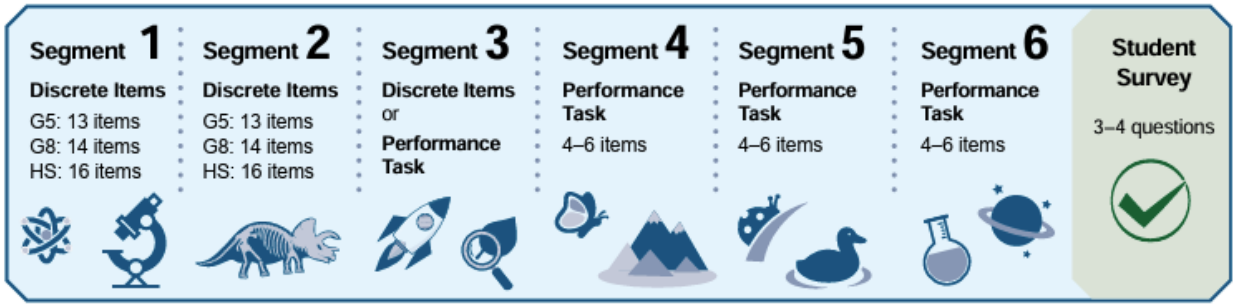


Figure 1.5: *Organization of the CAST Test (from CDE)*

For testing coordinators who administer the CAST over multiple sessions, one "pause point" is recommended immediately after the discrete item segments. If a pause occurs during a multipart item, that item will reset and the student must restart it when testing resumes.

DESIGNATED SUPPORTS AND ACCOMMODATIONS TO ALL STUDENTS DURING THE CAST

Accessibility Resources for the CAST

The California Science Test (CAST) incorporates a range of accessibility features intended to eliminate barriers and empower learners to demonstrate their scientific understanding without altering the underlying constructs evaluated. These accessibility features are organized across three distinct tiers: universal tools, designated supports, and accommodations.

Universal tools are accessible to all learners according to personal preference and need. Features in this category include scheduled breaks, a digital notepad, highlighting capabilities, a line reader, built-in reference charts, scratch paper, and screen enlargement options.

Designated supports are available to any student for whom an educator or instructional support team identifies a specific need, requiring no formal IEP or 504 plan. On the CAST, these supports encompass color contrast adjustments, screen masking, text-to-speech functionality, translated glossaries and test instructions, high-powered magnification, noise-canceling buffers, testing in a separate setting, simplified directions, and specialized science reference materials. Supports can be integrated within the digital testing environment or offered non-embedded. Given that designated supports remain underutilized across California, LEA leadership teams have a vital opportunity to expand systemwide literacy among staff and families while building coherent processes to match students with appropriate accessibility tools.

Accommodations are reserved specifically for students with documented IEP or Section 504 plans and must be formally specified within those legal documents. Approved CAST accommodations feature American Sign Language, braille formats, speech-to-text tools, word completion software, abacus tools, alternative response modes, large-print booklets, and print-on-demand testing. Similar to designated supports, accommodations must address specific accessibility needs while maintaining standard assessment rigor.

Selection of accessibility features should always occur on a student-by-student basis rather than applying blanket choices to entire student groups. To ensure seamless test-day experiences, learners should routinely utilize these features during regular instruction and local assessments. Educational leaders can consult the current California Assessment Accessibility Resources Matrix[12] for policy details and implementation steps. In addition, the Accessibility Resource Graphics[13] and the Science Accessibility Graphics[14] serve as practical, accessible tools to foster shared understanding and guide local continuous improvement planning.

All students taking the CAST have access to **universal tools**, which are features built into the test platform to support student success and reduce barriers during testing. These tools are available to everyone—regardless of language proficiency or disability status—and can be especially helpful for students who benefit from additional visual or organizational support.

[12] https://www.caaspp-elpac.org/resources/preparation/accessibility-resources/matrix
[13] https://www.caaspp-elpac.org/resources/preparation/accessibility-resources/graphics
[14] https://www.caaspp-elpac.org/s/docs/scienceresources.pdf

Universal tools include:

- **Digital notepad**: Students can jot down notes during the test to help organize their thinking.
- **Strikethrough tool:** Allows students to cross out answer options they've ruled out in multiple-choice questions.
- **Zoom:** Lets students enlarge test content to better view images or text.
- **Highlighter:** Available for text in passages and questions, useful for marking important information.
- **Mark for review:** Students can flag questions to revisit before submitting their test.
- **Glossary**: Some items include a pop-up glossary to define challenging terms or scientific vocabulary.
- **Breaks:** Students can take breaks between segments or as needed, as long as test security is maintained.

Tools within the CAST Interim Assessments are designed to advance equity and accessibility when embedded directly into routine classroom instruction and practice tests. In addition to Universal Tools, educators should activate available Designated Supports, particularly Text-to-Speech, if students regularly use them during daily instruction. Because these options align with Universal Design for Learning (UDL) principles, Designated Supports do not require an IEP or 504 plan and can be assigned to any student who benefits from them, ensuring familiarity long before test day. Local Educational Agencies (LEAs) can explore these accessibility features and preview the testing platform through the CAASPP Practice and Training Tests.[15]

For administration guidelines, visit the CAASPP and ELPAC Test Administration website.[16]

Understanding Achievement Level Descriptors (ALDs)

Achievement Level Descriptors (ALDs)[17] define what students know and can do at different performance levels on statewide assessments. ALDs are developed in four types, each serving a specific purpose during the design and scoring of assessments like CAST:

- **General ALDs:** Broad statements of performance expectations across grade levels.
- **Range ALDs:** Grade-level descriptions detailing how student knowledge progresses across performance levels.

[15] https://www.caaspp.org/practice-and-training/index.html
[16] https://www.caaspp.org
[17] https://www.cde.ca.gov/ta/tg/ca/castrangealds.asp

- **Threshold ALDs:** Developed and used by groups of educators, often including classroom teachers, during state-led standard setting to define the "borderline" between performance levels.
- **Reporting ALDs:** Finalized statements used for public reporting of student performance.

It's important to note that ALDs are not designed to guide classroom instruction or decisions about individual students. Instead, they help interpret large-scale assessment results alongside other data.

CAST Achievement Levels

CAST uses four achievement levels, each linked to a general ALD. These levels were updated in 2025 to improve clarity and alignment across assessments:

CAST Achievement Levels		
Level	**Label**	**Description**
4	Advanced	The student demonstrates advanced grade-level knowledge and skills and shows a sophisticated understanding of and ability to apply the knowledge and skills associated with the performance expectations of the California Next Generation Science Standards.
3	Proficient	The student demonstrates proficient grade-level knowledge and skills and shows a thorough understanding of and ability to apply the knowledge and skills associated with the performance expectations of the California Next Generation Science Standards.
2	Developing	The student demonstrates developing grade-level knowledge and skills and shows an initial understanding of and ability to apply the knowledge and skills associated with the performance expectations of the California Next Generation Science Standards.
1	Minimal (revised in 2025)	The student demonstrates minimal grade-level knowledge and skills and shows a limited understanding of and ability to apply the knowledge and skills associated with the performance expectations of the California Next Generation Science Standards.

Figure 1.6: Achievement Level Descriptors (from CDE).
For more information, visit the California Department of Education CAST page.

1.5 Reflection and Call to Action

Understanding California's science assessment system and the Science Indicator is essential for interpreting data accurately and driving continuous improvement. The foundational concepts in this section help district and school leaders move beyond seeing test scores as simple numbers to recognizing how the California Science Test (CAST), Achievement Level Descriptors (ALDs), and state accountability mechanisms can inform system-wide changes and advance educational equity.

As you consider next steps for your district or school, use the following actions and questions to guide your work.

Build System Literacy Around Science Assessment and Accountability
Ensure school site leaders, district administrators, and support teams possess an accurate understanding of the CAST structure, the Science Points methodology, and how science fits into California's accountability framework.

Questions to consider:

- How will your district and site teams build a shared understanding of the CAST design, universal tools, and Science Points scoring methodology, and what misconceptions exist regarding its "informational" status versus its growing role in LCFF Priority Area 4 and local planning?
- How are Achievement Level Descriptors (ALDs) used across your system to interpret system-level results, and how will teams ensure they are used appropriately rather than for individual student grading?

Examine Equity and Disaggregated Outcomes Across Student Groups
Analyze how the Science Indicator highlights disparities across student groups to ensure local improvement efforts address equity gaps and support underserved learners.

Questions to consider:

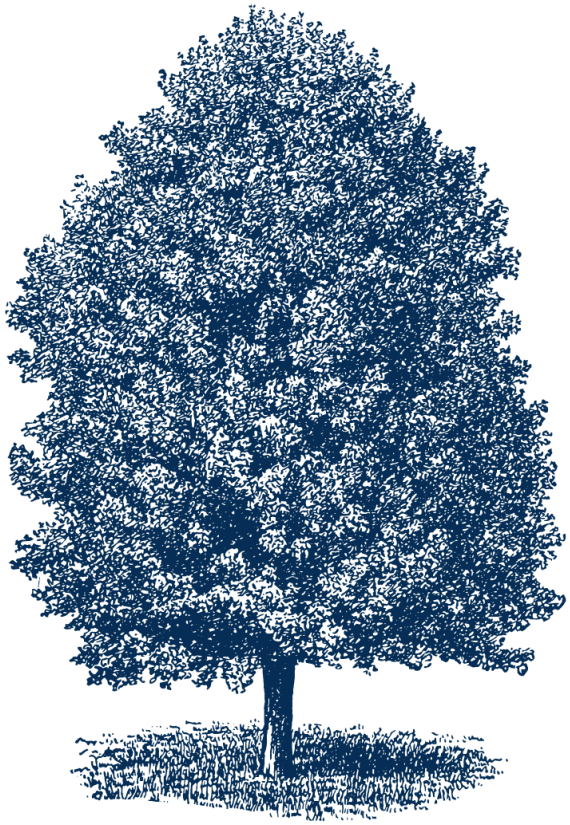
- What patterns, strengths, or performance gaps emerge when disaggregating CAST data by student group, and are any student groups performing at the Red performance level that would trigger mandatory science actions in your LCAP?
- How effectively are universal tools and accessibility features utilized during regular instruction so that all student groups can successfully demonstrate their learning on test day?

Integrate Science Data into Local Planning and Continuous Improvement
Connect insights from the Dashboard and CAST results directly to district priorities, resource allocation, and professional learning strategies.

Questions to consider:

- How is science data currently integrated into continuous improvement conversations, who is involved, and whose perspectives or roles might be missing when interpreting CAST results
- Where do your local planning documents (e.g., LCAP, SPSA, PL plans) explicitly reference the Science Indicator or CA NGSS implementation, and what opportunities exist to connect assessment insights to classroom-level instructional shifts?

The goal of building this foundational understanding is not simply to navigate state reporting requirements. It is to create a shared baseline of knowledge that enables educators and leaders to connect state-level indicators to local practice and equitable student experiences. In Section 2: Analyzing and Interpreting Science Data of this Field Guide, you will build on this foundation by learning how to access, analyze, and interpret science data to identify patterns, uncover systemic barriers, and take meaningful action.



SECTION 2: Analyzing and Interpreting Science Data

2.1 Introduction

Now that you've explored **Section 1: Understanding California's Science Assessment System, Section 2: Analyzing and Interpreting Science Data** helps you turn that understanding into action by guiding you through the process of accessing, analyzing, and interpreting science data—including CAST results—to support student learning and system improvement.

The purpose of **Section 2: Analyzing and Interpreting Science Data** is to build a case for the importance of using multiple data sources to better understand the overall needs of all students in your system and to identify the barriers in your system that prevent or limit access and inclusion for them. The disaggregation of student data helps reveal inequities, informs targeted support, and drives program improvement. Data, when properly analyzed and interpreted, helps leaders and educators make decisions, identify root causes for performance gaps, and monitor the impact of actions and changes to improve the learning of students.

Care should be taken in the analysis process to focus discussions on what the data reveals while challenging assumptions that arise from inherent biases and beliefs. When looking at student achievement data, inquiry around how the current design of the system is supporting or not supporting various students and how barriers might be removed to better support all student groups is far more productive than assigning blame on students or other educational partners.

This section will discuss two types of data worth considering. The first is student academic achievement data. This includes data collected annually, such as the California Science Test (CAST), as well as available local data, including benchmark assessments, interim assessments, or classroom summative assessments. The second type of data is local systems data. This includes data such as course enrollment, grades, attendance, allocated time for science, student interviews, or any data that can help to better understand possible reasons student performance is impacted.

By the end of this section, you will be able to:
1. Access, analyze, and interpret data from the California Science Test (CAST). 2. Identify possible sources of other student academic achievement data and local systems data to use to better understand the strengths, barriers, and opportunities which will increase science access and learning for all students in your system. 3. Utilize tools and templates to guide data analysis processes. 4. Consider actions and strategies to increase science learning opportunities for all students and to reduce science performance gaps between various student groups.

District/School Reflection Questions and Actions
1. In your system, what do you want the student's experience in science to look like? 2. What do you want their performance to look like at the end of their science learning experience? What is your student performance goal for all students in your system? 3. How is this vision and goal communicated to learning partners in your system?

2.2 Key Concepts & Terms

Here are a few foundational terms that will help you navigate this section.

- **Academic Achievement Data**: Data that measures a student's progress toward or achievement of standards and learning goals. Examples of sources for academic achievement data include the California Science Test (CAST), benchmark/interim assessments, or classroom summative assessments.
- **Local Systems Data**: Data that can help reveal access barriers in a system or the lived experience of students which impact student achievement. This includes data such as course enrollment, grades, attendance, allocated time for science, and student interviews.
- **Grain Size of Data**: A metaphor used to describe the level of detail in science data:
    - *Large-grain (Satellite)*: Broad patterns at the system level (e.g., CAST results)

    - *Medium-grain (Map)*: Trends within schools or subgroups (e.g., interim assessments)
    - *Fine-grain (Street)*: Classroom-level, real-time data (e.g., student work, observations)

  This concept helps educators choose the right type of data for specific decision-making purposes.
- **Data Inquiry Cycle**: A collaborative, structured process for analyzing data to improve teaching and learning. Stages include identifying a focus, collecting data, interpreting findings, planning actions, and monitoring results. This cycle helps teams avoid reactive or surface-level responses to data.
- **Root Cause Analysis**: A structured process for uncovering systemic reasons behind persistent problems or performance gaps. Tools include the *Fishbone Diagram* and *Five Whys Protocol*. This ensures actions target actual causes, not just symptoms.

2.3 Grain-Size of Science Data and Their Significance

We need to use the right data when making decisions about actions and strategies to expand science learning opportunities for students and reduce science performance gaps. An asset-based approach asks us to look beyond what students may not yet know or be able to do and consider the strengths, knowledge, experiences, and resources they bring to science learning. Examining data at the right grain-size helps us understand students' experiences and identify the conditions and opportunities that can be strengthened, rather than reducing students to performance gaps or deficit labels. Without careful attention to both the data we use and the lens through which we interpret it, we risk making decisions that further marginalize the very students we most want to serve.

Large-grain size data, sometimes called *satellite data*, illuminates patterns of achievement at a systems level and points us in directions for further investigation. This data often lacks context and nuance, failing to identify the lived experiences of students and student groups. Examples of this data include the California Science Test (CAST) and other end-of-year or end-of-course data.

Medium grain-size data, sometimes called *map data*, points us in a more focused direction by offering a clear picture of learning trends and gaps across the school community. It begins to help us identify student strengths and areas for growth as well as teacher instructional strengths and skill gaps. It may also begin to reveal possible structures in a

system that present barriers for access and support. Examples of this data include academic achievement data (e.g., interim assessments, benchmark assessments, diagnostic data) as well as local systems data (e.g., grades, course enrollment demographic data, attendance data, and time allocated for science instruction).

Fine-grain data, also known as *street data*, takes us to the ground level to listen to the voices and experiences of students and educators. It provides us with real-time, leading indicators of the complex work of school and instructional improvement. This data enables rapid feedback loops for decisions and practices. It helps us center the voices of the most vulnerable, including those currently at the margins of our schools and systems. Examples of this data include formative assessment, classroom learning walks, student/teacher surveys, teacher perception data, and teaching/learning artifacts.

District/School Reflection Questions and Actions
1. What large-grain (satellite) data, medium-grain (map) data, and fine-grain (street) data is currently available to your district/school for science? Discuss why this data may be helpful to analyze. 2. What additional data might you be able to collect or generate that will help you as you consider actions or strategies to increase science learning opportunities for all students and to reduce science performance gaps?



Student Achievement Data

In a balanced assessment system, assessments at all levels, from the classroom to state level, work together in a system that is comprehensive, coherent, and continuous. In such a system, assessments provide a variety of evidence to support educational decision making. Assessment at all levels should link back to an underlying model of student learning and provide indications of student growth over time. In such a system, the purpose and use of each assessment is clear and provides the right information to the right educational partners.[18]

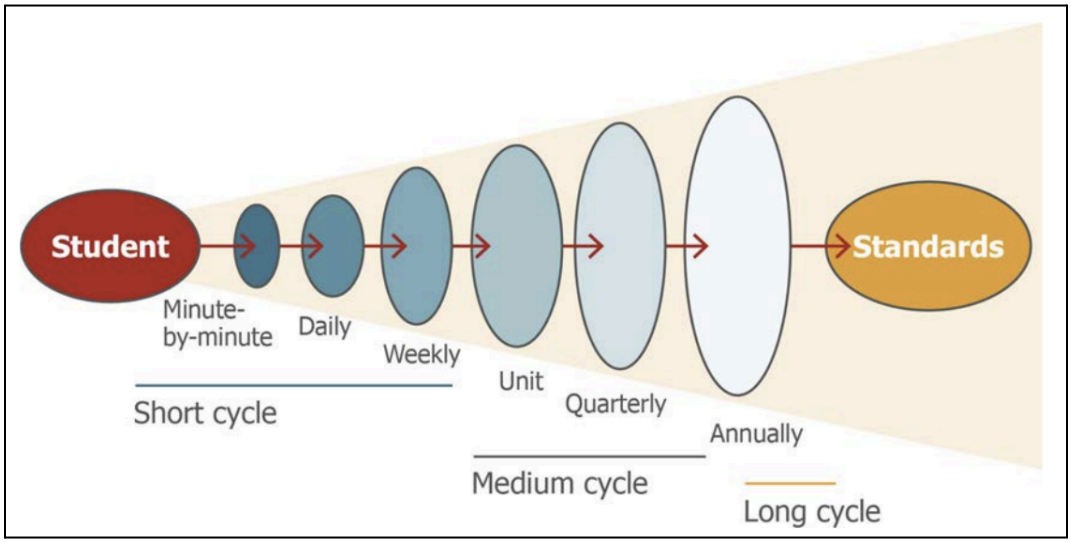


Figure 2.1: California system of assessments continuum. (Adapted from Herman and Heritage 2007.)

As described in Chapter 9 of the CA Science Framework[19], one way to think about assessments for different purposes is to view assessments as operating in different time frames or cycles: long, medium, and short. Each cycle provides information about learning and the effectiveness of instruction at varying levels of detail. **Figure 2.1** presents an overview of how these assessments work together across a school year. The size of the ovals represents the amount of information we get about student learning, while the color intensity shows how effective the feedback is in supporting students.

18 Assessment Centered Instruction. SDCOE. https://drive.google.com/file/d/1pzz6ihXdThGzA6Q1D5ujnAT-fmb2Wote/view?usp=sharing

19 California Science Framework (2016): https://www.cde.ca.gov/ci/sc/cf/cascienceframework2016.asp

Short Cycle: Formative Assessment or Assessment for/while Learning

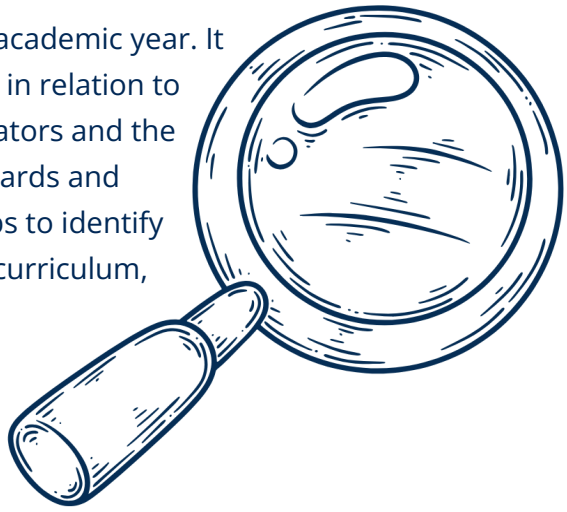
Formative assessment is a planned process teachers and students use during instruction that provides feedback to adjust ongoing teaching moves and learning tactics. It is not a tool or an event, nor a bank of test items or performance tasks embedded in learning (PTELs). Well-supported by research evidence, it improves students' learning in real time to achieve intended instructional outcomes.[20]

Medium Cycle Assessment: Assessment of/after Learning

Medium cycle assessment measures intermediate goals on the way to meeting end-of-year or end-of-course goals (e.g., Interim/benchmark assessments). It provides periodic snapshots of student learning throughout the year and occurs at key points of transferable learning within and at the end of a period of instruction (learning sequence, unit, quarterly).[21]

Long Cycle Assessment: Assessment of Student Learning, Assessment for School and Systemic Improvement

Long cycle assessment occurs at the end of a course or the academic year. It allows students to demonstrate what they know and can do in relation to the standards or competencies, and communicates to educators and the community the degree to which students are meeting standards and how they are performing over time. At a system level, it helps to identify possible strengths and areas of improvement in programs, curriculum, and instruction.[22]



20 Assessment Centered Instruction. SDCOE. https://drive.google.com/file/d/1pzz6ihXdThGzA6Q1D5ujnAT-fmb2Wote/view?usp=sharing

21 Assessment Centered Instruction. SDCOE. https://drive.google.com/file/d/1pzz6ihXdThGzA6Q1D5ujnAT-fmb2Wote/view?usp=sharing

22 Assessment Centered Instruction. SDCOE. https://drive.google.com/file/d/1pzz6ihXdThGzA6Q1D5ujnAT-fmb2Wote/view?usp=sharing

Table 2.1 below shows examples of different sources of data and what the analysis of data can reveal about student achievement based on the grain-size of the data. This is not a comprehensive list of data and you will need to determine what data is available and what data might need to be collected.

Table 2.1: Student Achievement Data

Data Source/Type	What The Data Can Reveal
California Science Test (CAST) Long Cycle Assessment Large-grain sized (Satellite) data Note: See **Section 2.4** of this field guide for more information on accessing and analyzing CAST data	• *Achievement Levels:* The percentage of students at each performance level (e.g., *Standard Exceeded, Standard Met, Standard Nearly Met, Standard Not Met*) shows how well students are understanding the California Next Generation Science Standards (CA NGSS) • *Strengths and Gaps:* Analysis by science domain (Physical Science, Life Science, Earth and Space Science) can highlight which content areas students are excelling in or struggling with • *Performance Gaps:* Disparities in achievement by student groups (e.g., race/ethnicity, socio-economic status, English Learners, students with disabilities) highlight equity concerns • *Impact of Instructional Changes:* Trends over multiple years can show whether changes in curriculum, pedagogy, or professional learning are making a difference • *School Comparisons:* Comparing results across schools can highlight where certain science programs or supports may be more effective. Cautionary Note: Attempting to do this requires analysis of other data to ensure a fair comparison • *Trends Over Time:* Longitudinal analysis can help track progress in science education over years and evaluate the sustainability of interventions that have been put into place over time
Benchmark/Interim Assessments Medium Cycle Assessment Medium-grain sized (Map) data	• *Performance Levels:* The number and percentage of students exceeding, meeting, and not meeting established learning targets • *Performance Gaps:* Disparities in achievement by student groups (e.g., race/ethnicity, socio-economic status, English Learners, students with disabilities) highlight equity concerns • *Impact of Best First Instruction and Interventions:* Trends over time can show whether interventions and instructional practices are making a difference • *Impact of Instructional Changes:* Trends over time can show whether changes in curriculum, pedagogy, or professional learning are making a difference • *Student Strengths and Areas of Growth:* Allows educators to identify strengths and areas for growth of students as well as those most in need of additional support • *Instructional Design:* Helps identify strengths and areas of growth in instructional practice and assessment design

Classroom Level Assessments Short Cycle and Medium Cycle Assessment Small-grain sized (Street) data	• *Monitoring Progress:* Allows educators to monitor progress towards learning goals and adjust instruction and support in real time • *Feedback:* Provides feedback to educators so instruction can be adjusted in response to student need; provides students feedback on their learning so they can self-monitor their own growth and learning • *Evidence of Learning:* Allows educators to determine how much students have learned in relation to learning targets and what still needs to be learned • *Student Strengths and Areas of Growth:* Allows educators the opportunity to identify strengths and areas for growth of students as well as those most in need of additional support

District/School Reflection Questions and Actions

1. The Science Assessment System Continuum[23] document from the *CA NGSS Toolkit for Student-Centered Assessment*[24] provides more detail into the cycles of assessment. Use this resource and the information in this section of the field guide to discuss the following questions:
    a. What are the purposes of short cycle, medium cycle, and long cycle assessment?
    b. How are they useful for students, teachers, and other learning partners in your system?
    c. What are some examples of assessment for each cycle? What other assessments do you use in your system?
    d. How can these assessments, when designed well, support and attend to student identity?
2. What student achievement data from the cycles of assessment will you use as you consider actions or strategies to increase science learning opportunities for all students and to reduce science achievement gaps?
3. Familiarize yourself with the organization and structure of the California Science Test (CAST) by reviewing the following resources:
    a. Organization of the California Science Test[25] - This document provides a brief overview of how CAST is organized.
    b. CAST Achievement Levels and Scale Score Ranges[26] - This document provides descriptions of the achievement levels and scale score ranges for the CAST.

23 https://drive.google.com/file/d/1ckC48Nhuwa3HU0ijHwQ8CqqfVaJTf99_/view?usp=drive_link

24 CA NGSS Toolkit for Student-Centered Assessment: https://www.sdcoe.net/ngss/toolkit

25 Organization of the California Science Test (CDE Resource, June 2025): https://www.caaspp-elpac.org/s/docs/organizationcast.pdf

26 CAST Achievement Levels and Scale Score Ranges (SDCOE CAST Data Institute Resource, Spring 2025): https://drive.google.com/file/d/1_wCIBRiqlEpOgjZE40Xe7Kc8Wds2p9YY/view?usp=sharing

c. CAST Science Domain Reporting Achievement Level Descriptors (ALDs)[27] - This document provides descriptions of the domain achievement levels for Life Sciences, Physical Sciences, and Earth and Space Sciences.
d. CAST Practice and Training Tests[28] - Go to this website to see example CAST items by grade level. Once on this page, click the "Student Access to Tests" link, sign in as a guest user in a guest session, select a grade level (grade 5, 8, or 9-12), and then select either the CAST practice test or training test.

Other Science Data in Local Systems

Looking at student achievement data helps you identify patterns and trends in student performance that are important when making decisions. It helps you focus on areas of strength as well as areas for improvement in the system to better support all student groups. The data may show whether trends over time show improvement, stagnation, or decline in performance. It may also reveal any differences by grade level or school site. Student achievement data can help you keep a focus on targeted underserved student groups: multilingual learners, foster youth, students with disabilities, and socioeconomically disadvantaged students. As important as this data is, it is not enough to simply know that students or student groups are performing above or below their peers. To get to the root causes for why the performance gaps are occurring, it is necessary to analyze other data which might uncover the possible reasons for the gaps, including barriers in the system that prevent student access and inclusion.

Science data available in your local system (e.g., schools, district) can help you better understand the lived experiences of students in schools and classrooms. This data helps reveal how current structures, practices, policies, beliefs, and educator actions either support or hinder student access to deep, meaningful science learning experiences. It can also highlight opportunities and barriers affecting student learning and performance in science. **Table 2.2** (below) shows examples of different sources of data and what the analysis of data can reveal within your system. This is not a comprehensive list of data and you will need to determine what data is available and what data might need to be collected.

27 CAST Science Domain Reporting Achievement Level Descriptors (SDCOE CAST Data Institute Resources, Spring 2025): https://drive.google.com/file/d/1Lz-Oh98w4SSB6YJWqSMq3ZbI9cw_JlaW/view?usp=sharing

28 CAST Practice Tests (CAASPP/ELPAC): https://www.caaspp-elpac.org/resources/preparation/practice-and-training-tests

Table 2.2: Local Systems Data

Data Source/Type	What The Data Can Reveal
Master Schedule/ Course Enrollment Demographics	• Do all students have access to a range of science courses that address the breadth of CA NGSS (physical sciences, life science, and Earth and space sciences)? • Do course enrollment demographics match the school demographics? • Do course prerequisites prevent access to science courses for certain student groups? • Are there student groups who have limited access to science courses?
Allocated Time for Science (Elementary)	• Are science learning opportunities provided to students across all grades from kindergarten through 5th grade? • Are there times when students don't have access to science because of intervention or support programs that prevent student participation in science? • What does data show regarding which demographics or student groups face the highest rate of scheduling conflicts? • Is there adequate time allocated for students to learn science in a way that addresses the breadth of CA NGSS?
Grades/Transcript Audits	• How well do grades reflect student understanding of CA NGSS? • Are there grade differences across different student groups? • How are grades determined and what do they communicate to students?
Attendance Data	• Are there attendance patterns that may impact student learning in science?
Learning Walks and Classroom Observations	• How is instruction organized to support student engagement and learning? • What strategies and scaffolds are available to support the learning of all students, especially those that need additional support? • To what degree do the instructional tasks support student engagement and learning?
Teaching and Learning Artifacts	• How are lessons planned using principles of Universal Design for Learning? • How is formative assessment being used to guide learning and provide students feedback? • What do grading policies and practices prioritize and communicate about student performance and learning? • What does student work reveal about expectations for learning and overall engagement?
Student Shadowing	• What opportunities do targeted students have to engage in meaningful tasks that support their learning?

	• In what ways are targeted students engaging and participating in tasks and discourse that supports their learning?
Student Surveys, Interviews, and Focus Groups	• In what ways do students feel supported, challenged, and included? In what ways do they not? • How do students view their relationships with teachers and peers? • What activities and instructional approaches help students learn best? • What obstacles and barriers are students facing that impede their learning?
Teacher Surveys, Interview, Focus Groups	• In what ways are teachers experiencing success in their classroom? • In what ways are teachers supporting targeted groups of students? • What obstacles, challenges, and barriers are teachers facing that impact their planning, instruction, and assessment of student learning? • What supports do teachers want that will help them in their practice? • In what areas do teachers want to grow professionally?

District/School Reflection Questions and Actions
1. What local systems data is currently available to help you analyze and better understand the lived student experience and possible access barriers for students? 2. What local systems data might need to be collected to better understand the lived student experience and possible access barriers for students? 3. What local systems data will you use as you consider actions or strategies to increase science learning opportunities for all students and to reduce science achievement gaps?

2.4 Accessing California Science Test (CAST) Data

There are several resources available to access and analyze California Science Test (CAST) data results. In this section we will discuss some of these resources and provide information to help you look at CAST data and begin to analyze the results.

California Dashboard Science Indicator Data

The *California School Dashboard*[29] is an online tool designed to help communities across the state access important information about schools and districts. The California School

29 California School Dashboard: https://www.caschooldashboard.org/

Dashboard reports multiple state indicators, including the Science Indicator. In this field guide we will focus only on the Science Indicator. For more information about the other indicators, visit the *Dashboard Communications Toolkit*[30].

Beginning with the 2026 Dashboard, Science is a full state indicator within LCFF Priority Area 4: Student Achievement. Science is not included in the 2026 DA eligibility determination but will be incorporated into DA eligibility beginning in 2029.

Accessing the Science Indicator on the Dashboard

You can find the science indicator by going to the California School Dashboard website at https://www.caschooldashboard.org[31]. Once you are on the home page (see **Figure 2.2** below), you can use the search features to find the school or district whose data you would like to see as well as the year of the data. Science data on the Dashboard is available as of 2024.

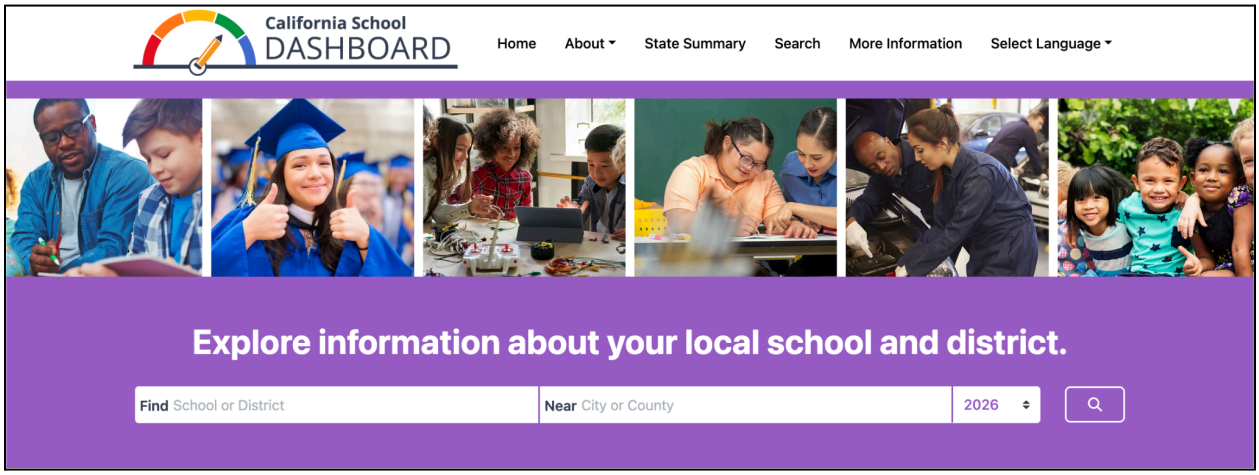


Figure 2.2: The California School Dashboard home page. You can use the search features to find school and district data for a selected year.

30 Dashboard Communications Toolkit: https://www.cde.ca.gov/ta/ac/cm/dashboardtoolkit.asp

31 California School Dashboard: https://www.caschooldashboard.org

After selecting a school or district and reporting year, locate the Science Indicator among the Dashboard's state measures. **Figure 2.3** below shows an example of the card for the Science Indicator in 2026.

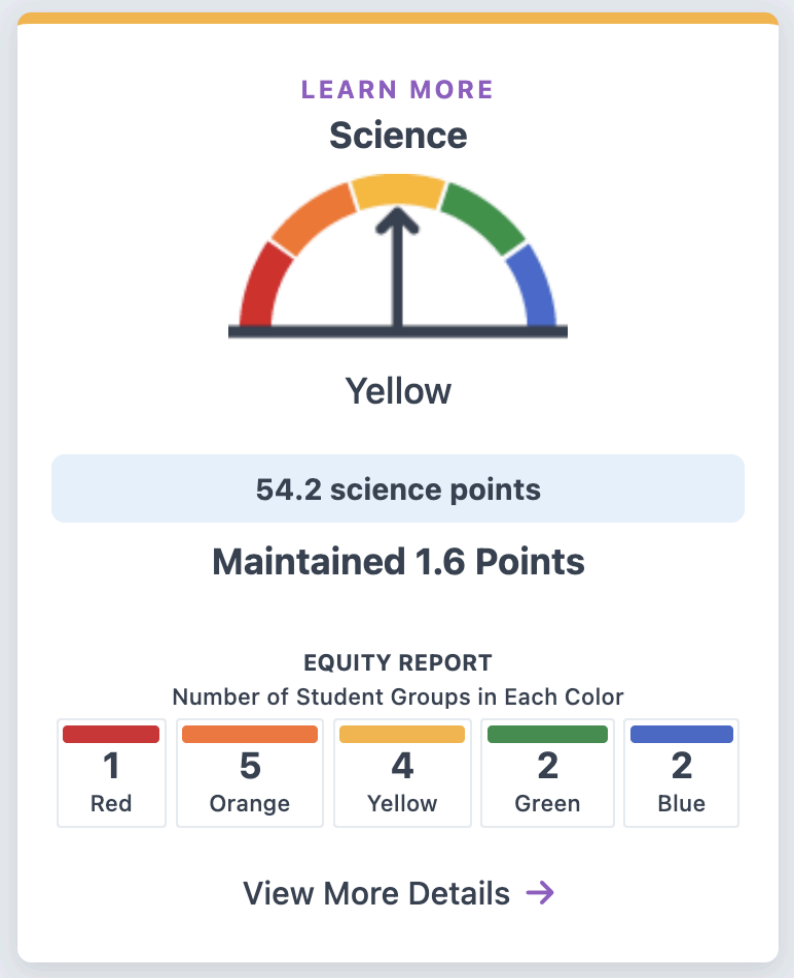


Figure 2.3: The Science Indicator as displayed as a state indicator on the 2026 California School Dashboard. The data in this example is for the State of California.



By clicking on the "View More Details" link on the Science Indicator card, you will be able to explore student groups by performance level. A card will be available for each student group. The cards are organized by color, which can be viewed by clicking the different colors at the top of the section. **Figure 2.4** (below) shows an example of the available information on a student group card.

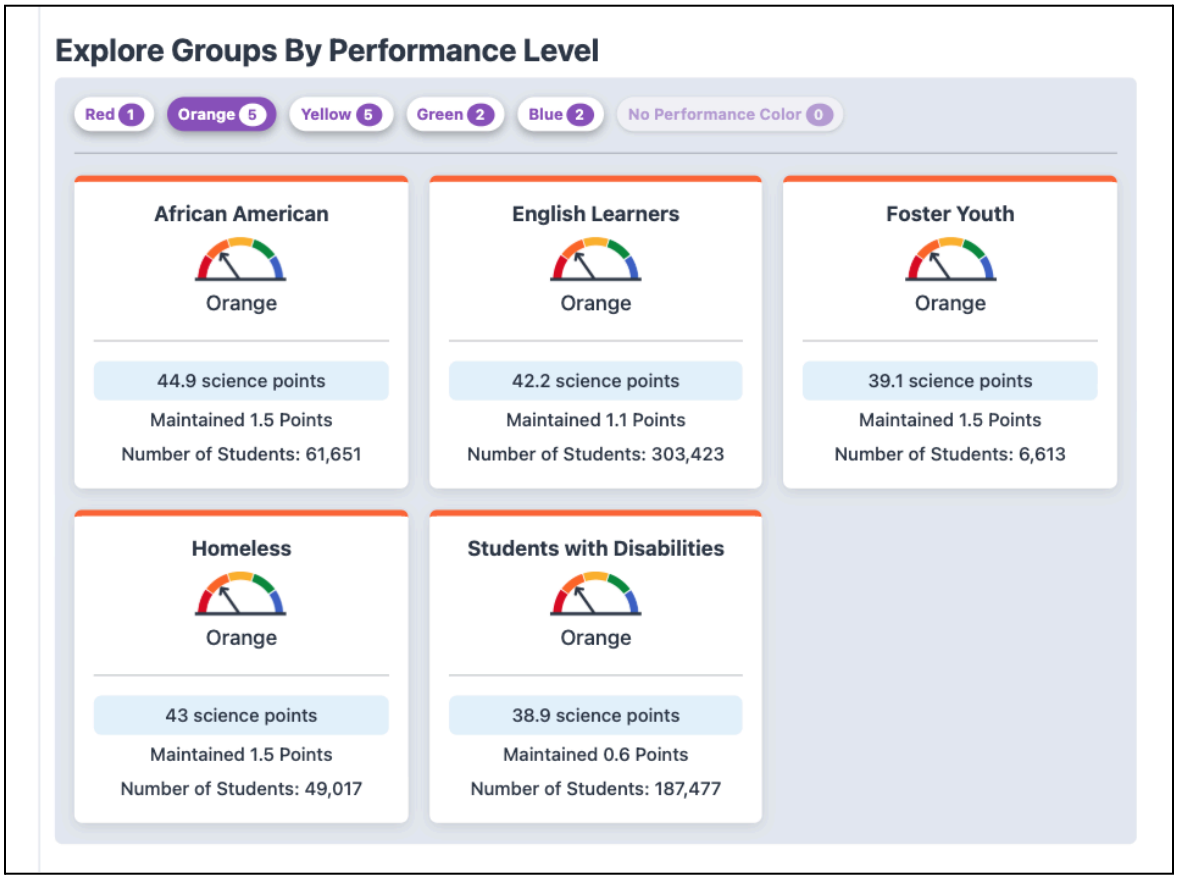


Figure 2.4: Science Indicator performance information example for student groups in the orange performance level on the 2026 California School Dashboard.

Science Data Available on the Dashboard

Student performance on the California Science Test (CAST) and the California Alternate Assessment for Science (CAA for Science) is used to determine the results for this indicator. The Science Indicator is calculated using two components: Science Points (SPs) and participation rate.

Science points are a simplified way to understand student performance on the CAST and CAA for Science. While each grade level has its own unique scale score range, SPs always range from 0 to 100. This makes it easier to interpret results across grades. A student's scale score is converted into SPs, where 0 is the lowest possible score and 100 is the highest possible score.

For students who take the CAA for Science, their scores are matched to the CAST through a crosswalk. If a student scores in Level 1, 2, or 3 on the CAA for Science, they are given the highest possible score for that same level on the CAST. This scale score is then used to figure out how many SPs the student earned.

Beginning with the 2026 Dashboard, the participation rate calculation no longer includes the grace periods used in previous years. For science, the participation rate denominator includes students enrolled at the LEA or school between the first date of science testing and the final date of the LEA's selected assessment window. The 95 percent participation requirement remains in effect. When an LEA, school, or student group falls below 95 percent participation, the number of students needed to reach 95 percent is factored into the Science Indicator results through the participation-rate penalty.

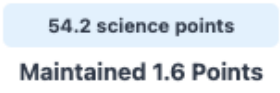
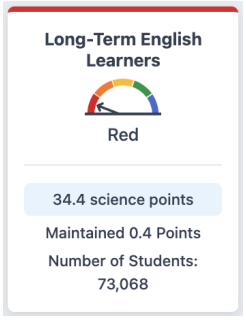
The *Science Indicator*[32] webpage on the CDE website provides a description of how Science Points and the participation rate are calculated.

Table 2.3 (below) provides a summary of some of the science data that can be reviewed and analyzed on the Dashboard. When conducting such an analysis, it is important to make and record observations (statements of fact that all agree on) versus assumptions (statements for why the data is the way it is that are accepted as true without proof). Assumptions are often based on biases and beliefs we have, and should be challenged. Additional data should be sought and analyzed to explore any questions, wonderings, or assumptions that come up.

Table 2.3: Science Data on the Dashboard

Data	Questions/Information
Performance Colors Example:	The performance colors for the Science indicator follow the same five-color system as other indicators: Blue (highest) to Red (lowest) with Green, Yellow, and Orange in between. Performance levels are determined by a combination of current year performance (status) and the change from the previous year (change). For a more detailed

32 Science Indicator: https://www.cde.ca.gov/ta/ac/cm/dashboardscience.asp

 Yellow	analysis of performance colors, go to the CDE School Dashboard Additional Reports and Data[33] website, search for a school/district/county, then choose the 5x5 Science Placemat Report. Questions to consider when looking at this data: • Did the performance color (status) change or stay the same from the previous year? • What student groups are in each color? What student groups changed color from the previous year? • How does student performance across schools compare? Are there any notable outliers? • What questions or wonderings come to mind as you look at this data set?
Science Points Example:  	Science Points (SPs) are a simplified way to understand student performance on the CAST and CAA for Science. While each grade level has its own unique scale score range, SPs always range from 0 to 100. This makes it easier to interpret results across grades. A student's scale score on the CAST is converted into SPs, where 0 is the lowest possible score and 100 is the highest possible score. The average SPs for a school or district using all students' SPs values determines the performance color (status) reported on the Dashboard. Questions to consider when looking at this data: • How much did the Science Points change in the performance of all students or individual student groups? • How much did the Science Points change for different schools? Are there notable outliers? • What questions or wonderings come to mind as you look at this data set?
Student Groups by Performance Color/ Science Points Example:  	Questions to consider when looking at this data: • How does the performance of each student group compare to the average Science Points (SPs) for all students? • What differences exist between the different student groups? Are some student groups under performing or out performing others and if so, by how much? • What questions or wonderings come to mind as you look at this data set? • How does student performance compare to the overall goal for science student outcomes for your system?

33 CDE School Dashboard Additional Reports and Data: https://www6.cde.ca.gov/californiamodel/

Participation Rate	LEAs, schools, and student groups are expected to meet at least 95 percent participation in science. When participation is below 95 percent, a participation-rate penalty can lower the reported Science Points and therefore affect Status, Change, and performance color. Beginning with the 2026 Dashboard, students enrolled between the first day of science testing and the final day of the LEA's testing window are included in the participation-rate calculation; previous grace periods have been eliminated[34]. Questions to consider when looking at this data: • Is participation at or above 95 percent overall and for each student group? • Which groups are below 95 percent? • How might the participation-rate penalty be affecting Science Points or performance color?

District/School Reflection Questions and Actions

1. Use the questions in **Table 2.3** to review and analyze the Dashboard Science Indicator data of student performance on the CAST. Document your analysis of the data as well as the questions or wonderings that come up. A sample data analysis template is available in **Section 2.5** of this field guide that can be used to document your analysis.
2. The large-grain (satellite) data available from the Science Indicator on the Dashboard may reveal some patterns or information about student performance that should be further investigated. Based on your review and analysis of the data, what wonderings or questions might be investigated further using local systems data?

CAASPP CAST Results

The *California Assessment of Student Performance and Progress (CAASPP)*[35] website gives you more detailed data of student performance on the California Science Test (CAST). This data includes percentages of students in each achievement level, performance of specific student groups, grade level data, domain level data, and performance data across multiple years.

34 https://www.cde.ca.gov/ta/ac/cm/dashboardscience.asp
35 CAASPP Test Results for California's Assessments: https://caaspp-elpac.ets.org/caaspp

Accessing Science Data on CAASPP Website

You can access the student performance results from the CAST by going to the California Assessment of Student Performance and Progress (CAASPP) website at https://caaspp-elpac.ets.org/caaspp[36] and clicking on the science link. From the "Test Results at a Glance" page, you can search results for a school, district, or county by using the search field in the upper right hand corner of the screen. You can filter by year, grade, student group, or school type to find specific results. **Figure 2.5** (below) shows the results for all California students across all grade levels on the 2024 administration of the CAST. You can use this page and the filters to quickly see the percentage of students within each achievement level for any criteria selected.

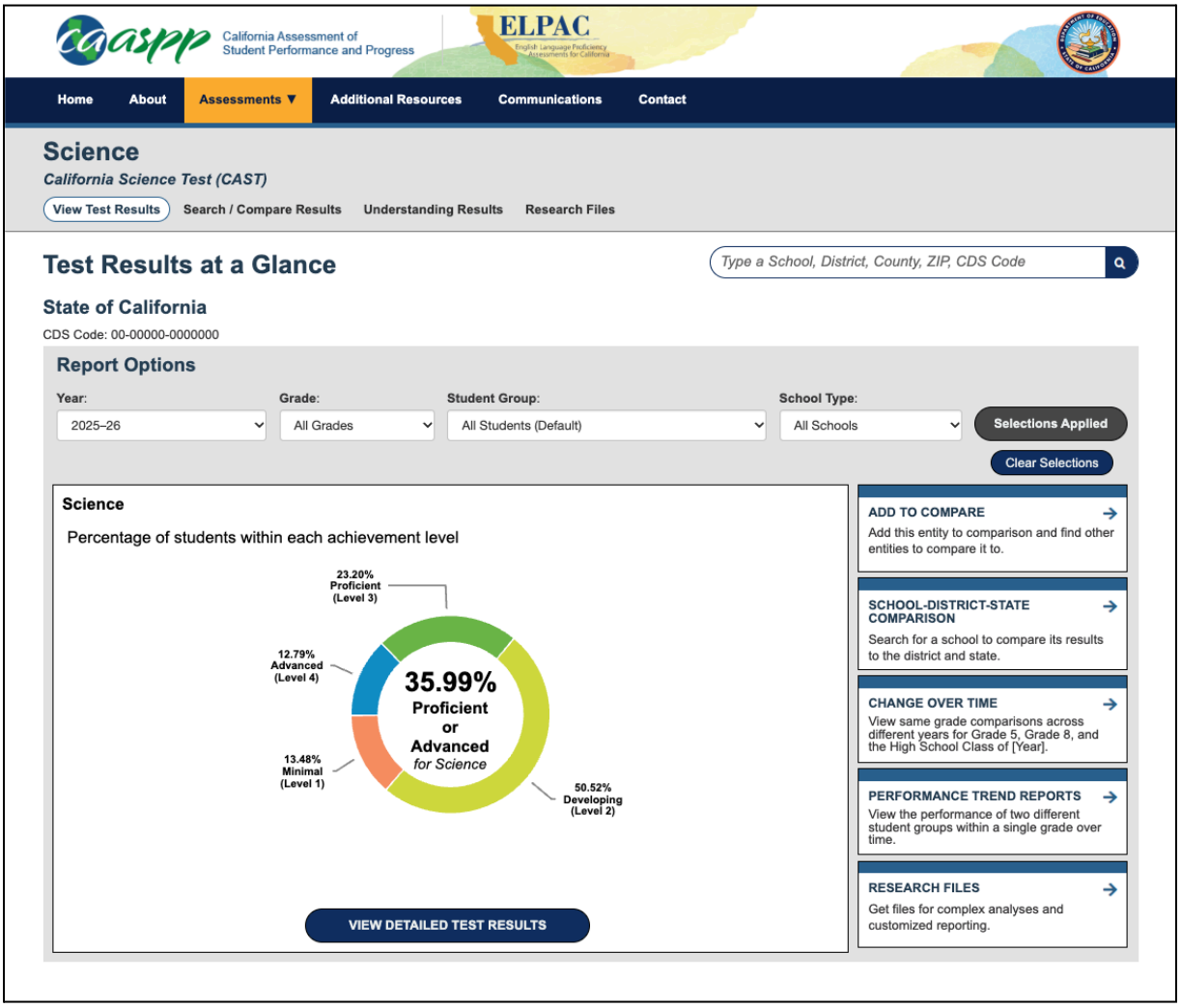
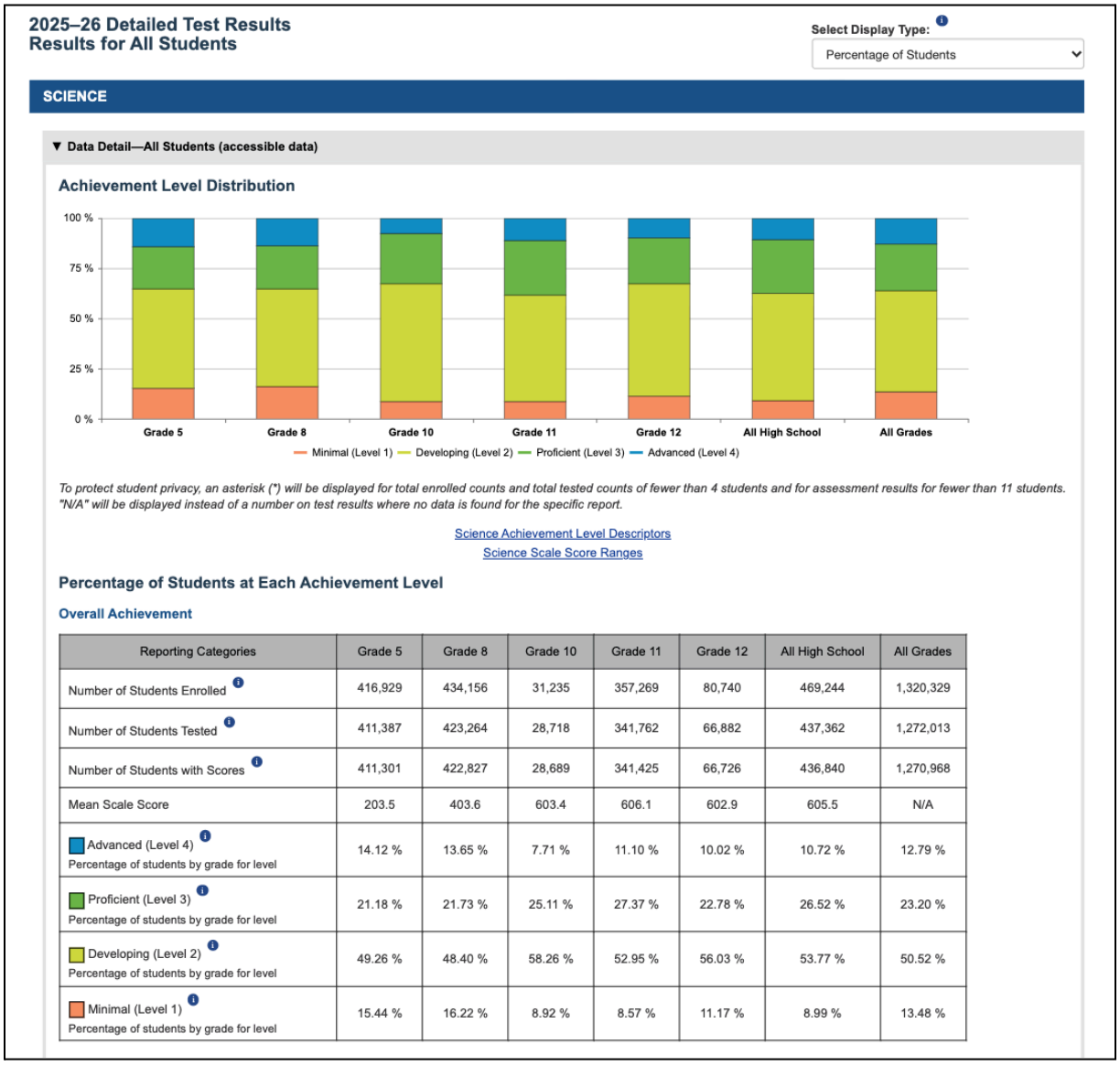


Figure 2.5: The *Test Results at a Glance* page for science on the CAASPP website. The 2026 data presented is for the State of California.

36 CAASPP Test Results for California's Assessments: https://caaspp-elpac.ets.org/caaspp

By clicking on the "View Detailed Test Results" button below the data chart, you can see more specific data related to the distribution of achievement levels, the number of students enrolled/tested/with scores, the number/percentage of students in each performance level, and domain specific (Life Science, Physical Science, Earth and Space Science) achievement levels. This data can be further filtered by student groups. **Figure 2.6** (below) shows a sample detailed report and **Figure 2.7** (below) shows a sample domain report for all California students across all grade levels on the 2026 administration of CAST.



2025–26 Detailed Test Results
Results for All Students

Select Display Type: Percentage of Students

SCIENCE

▼ Data Detail—All Students (accessible data)

Achievement Level Distribution

To protect student privacy, an asterisk (*) will be displayed for total enrolled counts and total tested counts of fewer than 4 students and for assessment results for fewer than 11 students. "N/A" will be displayed instead of a number on test results where no data is found for the specific report.

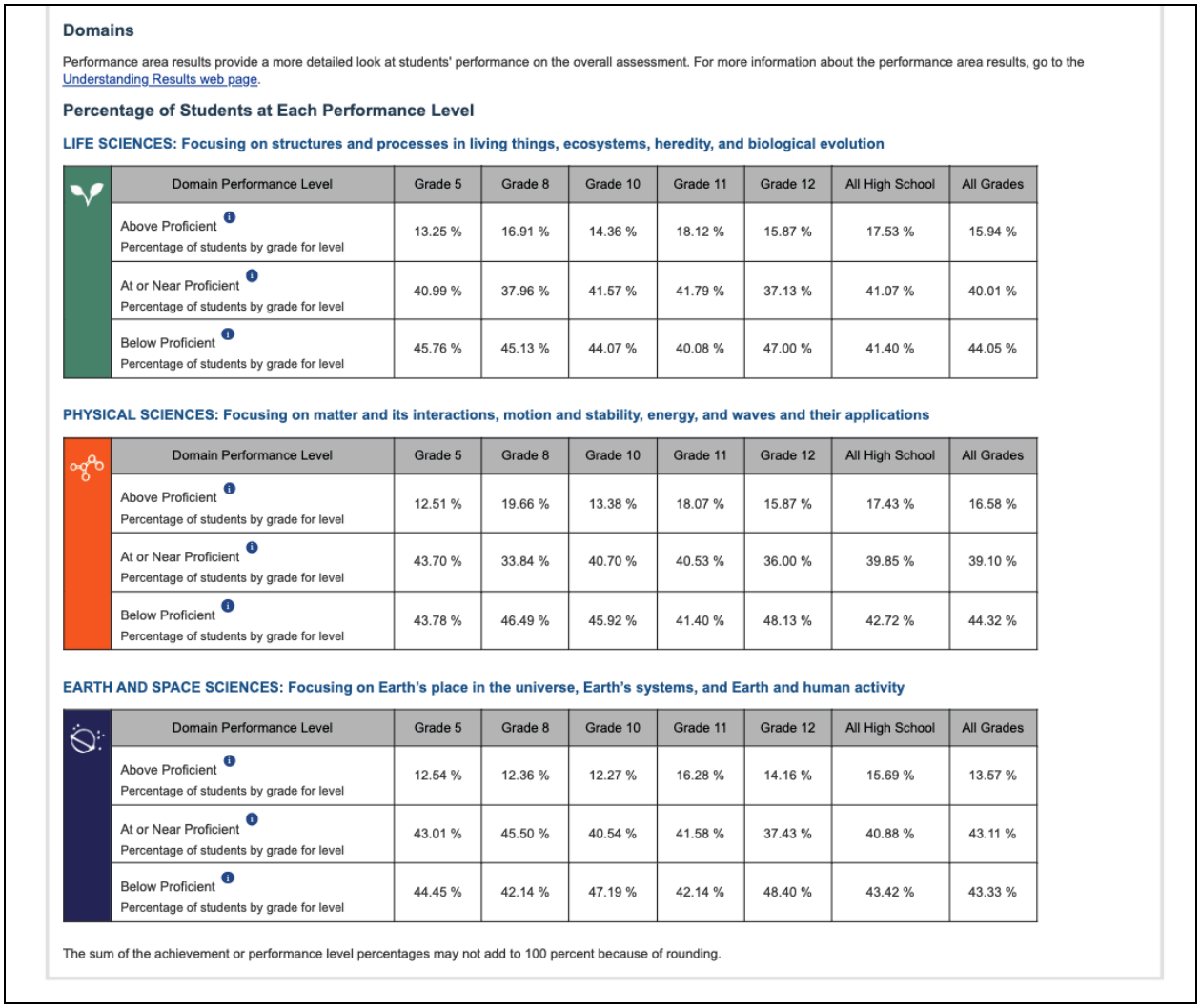
Science Achievement Level Descriptors
Science Scale Score Ranges

Percentage of Students at Each Achievement Level

Overall Achievement

Reporting Categories	Grade 5	Grade 8	Grade 10	Grade 11	Grade 12	All High School	All Grades
Number of Students Enrolled	416,929	434,156	31,235	357,269	80,740	469,244	1,320,329
Number of Students Tested	411,387	423,264	28,718	341,762	66,882	437,362	1,272,013
Number of Students with Scores	411,301	422,827	28,689	341,425	66,726	436,840	1,270,968
Mean Scale Score	203.5	403.6	603.4	606.1	602.9	605.5	N/A
Advanced (Level 4) Percentage of students by grade for level	14.12 %	13.65 %	7.71 %	11.10 %	10.02 %	10.72 %	12.79 %
Proficient (Level 3) Percentage of students by grade for level	21.18 %	21.73 %	25.11 %	27.37 %	22.78 %	26.52 %	23.20 %
Developing (Level 2) Percentage of students by grade for level	49.26 %	48.40 %	58.26 %	52.95 %	56.03 %	53.77 %	50.52 %
Minimal (Level 1) Percentage of students by grade for level	15.44 %	16.22 %	8.92 %	8.57 %	11.17 %	8.99 %	13.48 %

Figure 2.6: A sample *Detailed Test Results* report. The 2026 data presented is for the State of California.



Domains

Performance area results provide a more detailed look at students' performance on the overall assessment. For more information about the performance area results, go to the Understanding Results web page.

Percentage of Students at Each Performance Level

LIFE SCIENCES: Focusing on structures and processes in living things, ecosystems, heredity, and biological evolution

Domain Performance Level	Grade 5	Grade 8	Grade 10	Grade 11	Grade 12	All High School	All Grades
Above Proficient Percentage of students by grade for level	13.25 %	16.91 %	14.36 %	18.12 %	15.87 %	17.53 %	15.94 %
At or Near Proficient Percentage of students by grade for level	40.99 %	37.96 %	41.57 %	41.79 %	37.13 %	41.07 %	40.01 %
Below Proficient Percentage of students by grade for level	45.76 %	45.13 %	44.07 %	40.08 %	47.00 %	41.40 %	44.05 %

PHYSICAL SCIENCES: Focusing on matter and its interactions, motion and stability, energy, and waves and their applications

Domain Performance Level	Grade 5	Grade 8	Grade 10	Grade 11	Grade 12	All High School	All Grades
Above Proficient Percentage of students by grade for level	12.51 %	19.66 %	13.38 %	18.07 %	15.87 %	17.43 %	16.58 %
At or Near Proficient Percentage of students by grade for level	43.70 %	33.84 %	40.70 %	40.53 %	36.00 %	39.85 %	39.10 %
Below Proficient Percentage of students by grade for level	43.78 %	46.49 %	45.92 %	41.40 %	48.13 %	42.72 %	44.32 %

EARTH AND SPACE SCIENCES: Focusing on Earth's place in the universe, Earth's systems, and Earth and human activity

Domain Performance Level	Grade 5	Grade 8	Grade 10	Grade 11	Grade 12	All High School	All Grades
Above Proficient Percentage of students by grade for level	12.54 %	12.36 %	12.27 %	16.28 %	14.16 %	15.69 %	13.57 %
At or Near Proficient Percentage of students by grade for level	43.01 %	45.50 %	40.54 %	41.58 %	37.43 %	40.88 %	43.11 %
Below Proficient Percentage of students by grade for level	44.45 %	42.14 %	47.19 %	42.14 %	48.40 %	43.42 %	43.33 %

The sum of the achievement or performance level percentages may not add to 100 percent because of rounding.

Figure 2.7: A sample report of student performance on the science domains of Life Science, Physical Science, and Earth and Space Sciences. The 2026 data presented is for the State of California.

In addition to these reports, you can create school-district-state comparison reports, change over time reports, and performance trend reports of CAST data.

Science Data Available on the CAASPP Website

Table 2.4 (below) provides a summary of some of the science data that can be reviewed and analyzed on the CAASPP website. When conducting such an analysis, it is important to make and record observations (statements of fact that all agree on) versus assumptions (statements for why the data is the way it is that are accepted as true without proof). Assumptions are often based on biases and beliefs we have, and should be challenged. Additional data should be sought and analyzed to explore any questions, wonderings, or assumptions that come up.

Table 2.4: Science Data on the CAASPP Website

Data	Questions to consider when looking at this data:
Achievement Levels	• What percentage of students are performing at each achievement level? • What questions or wonderings come to mind as you look at this data set? • How does student performance compare to the overall goal for science student outcomes for your system?
Grade Level	• What percentage of students are performing at each achievement level at each grade level? • Are there differences in the percentages of students performing at each achievement level at different grade levels? • What questions or wonderings come to mind as you look at this data set?
Student Groups	• What percentage of students are performing at each achievement level for each student group? • How does the performance of each student group compare to the performance for all students? • What differences exist between the different student groups? Are some student groups under performing or out performing others and if so, by how much? • What questions or wonderings come to mind as you look at this data set?
Performance Trends	• How is the overall performance of students changing over time? • How is the performance of different student groups changing over time? • Are some student groups showing increases or decreases in performance more than others? If so, by how much? • What questions or wonderings come to mind as you look at this data set?
School Reports	• How does the performance of all students in one school compare to another school? • How does the performance of different student groups in one school compare to another school? • What questions or wonderings come to mind as you look at this data set?
Domain Levels	• How are students performing across the different domains of Life Science, Physical Science, and Earth and Space Science?

Data	Questions to consider when looking at this data:
Note: Refer to this CAST Science Domain Reporting Achievement Level Descriptors (ALDs)[37] - document for descriptions of the domain levels for Life Sciences, Physical Sciences, and Earth and Space Sciences.	• Are students performing higher or lower in one science domain than another? • Are some student groups showing increases or decreases in performance more than others? If so, by how much? • What questions or wonderings come to mind as you look at this data set?
Mean Scale Score Note: Refer to the CAST Achievement Levels and Scale Score Ranges[38] document for descriptions of the achievement levels and scale score ranges for the CAST.	• What is the average mean scale score for different student groups? • How is the average mean scale score changing over time for different student groups? Are some student groups showing increases or decreases more than others? If so, by how much? • Is the average mean scale score higher or lower for different student groups? • Are there student groups where the average scale score is closer to the minimum or maximum values for the achievement range? • What questions or wonderings come to mind as you look at this data set?

Some notes about CAST data worth considering:

- CAST results are available in the three domains of Life Science, Physical Science, and Earth and Space Sciences. The Physical Science domain includes both physics and chemistry standards and cannot be broken down into each subject.
- CAST data cannot be broken down into specific performance expectations. This is due to the small number of specific test items related to a performance expectation. If a standard includes only one or two items, the resulting data are insufficient for making statistically meaningful inferences about student performance.
- In both of these cases, it is important to consider other local assessments that may be used for analysis purposes, including district, site, and classroom generated short cycle and medium cycle assessments.

37 CAST Science Domain Reporting Achievement Level Descriptors (SDCOE CAST Data Institute Resources, Spring 2025): https://drive.google.com/file/d/1Lz-Oh98w4SSB6YJWqSMq3ZbI9cw_JlaW/view?usp=sharing

38 CAST Achievement Levels and Scale Score Ranges (SDCOE CAST Data Institute Resource, Spring 2025): https://drive.google.com/file/d/1_wCIBRiqIEpOqjZE40Xe7Kc8Wds2p9YY/view?usp=sharing

District/School Reflection Questions and Actions
1. Use the questions in **Table 2.4** to review and analyze the data of student performance on the CAST from the CAASPP website. Document your analysis of the data as well as the questions or wonderings that come up. A sample data analysis template is available in **Section 2.5** of this field guide that can be used to document your analysis. 2. The large-grain (satellite) data available from the California Science Test (CAST) may reveal some patterns, information, or performance gaps between different student groups that should be further investigated. Based on your review and analysis of the data, what wonderings or questions might be investigated further using local systems data?

Other Science Data Sources

In addition to the Science Indicator on the California School Dashboard and CAASPP websites discussed previously, there are several other resources that might assist your analysis of student performance and achievement. **Table 2.5** (below) describes some of the possible data resources to explore further. When using these resources, the questions in **Table 2.3** and **Table 2.4** may be helpful during the data analysis process.

Table 2.5: Other Science Data Resources

Resource	Link/Description
DataQuest	http://dq.cde.ca.gov/dataquest/ DataQuest provides meaningful data and statistics about California's TK/K-12 public educational system that supports a wide variety of informational, research, and policy needs. Summary and detailed data reports are available for multiple subject areas at the school, district, county, and state levels.
5x5 Science Placemat Report	For a more detailed analysis of performance colors, go to the CDE School Dashboard Additional Reports and Data[39] website, search for a school/district/county, then choose the 5x5 Science Placemat Report.
Assessment, Accountability & Continuous Improvement (AACI) Tableau Data Portal	https://public.tableau.com/app/profile/rcoe Data reports which allow educational stakeholders to view performance various assessments using publicly-accessible data. This resource was created by the Riverside County Office of Education.

39 CDE School Dashboard Additional Reports and Data: https://www6.cde.ca.gov/californiamodel/

2.5 Tools for Analyzing and Interpreting Science Data

Increased student understanding and learning of science concepts, processes, and skills as outlined in the Next Generation Science Standards (NGSS) is a primary goal for science programs in schools and districts. Their demonstration of this understanding and learning through multiple assessment opportunities provides evidence to educators that curriculum and instruction is fully aligned to the NGSS and that the learning needs of all students are being met to accomplish this goal.

The analysis of large-grain (satellite) data from the CAST begins to paint a picture of how well this goal is being accomplished. Most likely, even when the overall percentage of students meeting or exceeding standard is high, the data will reveal differences in performance among various student groups. The range of possible causes for these differences cannot be determined from one data source alone, especially if the only data being analyzed is CAST data.

Often, the question that arises when differences in the performance of various student groups is apparent in data is, "Why might this be happening?" There is no easy answer to this question and the cause is often found in the structures of systems as well as the classroom instruction and support provided to students.

Too often, plans and actions put in place to respond to differences in achievement levels of student groups do not address the root causes responsible for the gaps, resulting in no changes to student learning and performance. Worse yet, blame is often placed on students, teachers, or administrators resulting in increased resistance, paralysis for any desire for change, or the implementation of strategies or actions that further marginalize or disengage students from learning. It is only through a thoughtful data analysis process that looks through multiple data sources can you enact a transformational plan and respond to the following question.

What changes or successful actions can we implement to have the greatest impact on student learning and performance in our system?

Data Inquiry Cycles

A data inquiry cycle is a structured, reflective process used by teams of educators who come together to examine data deeply in order to improve practices, solve problems, and drive better outcomes—especially in teaching and learning. This cycle emphasizes collaborative sense-making, reflection, and action by:

- Focusing on learning from the data, not just analyzing it,
- Iterative questioning and reflection, and
- Determining actionable next steps based on evidence.

Table 2.6 (below) describes the common stages of a data inquiry cycle. Before beginning a cycle, it is important to identify the people who will participate on the data team. Successful teams are often comprised of educators who bring different perspectives and insights, such as classroom teachers, site administrators, and district leaders.

Table 2.6: Common Stages of a Data Inquiry Cycle

1. Identify a Problem or Area of Focus
• Define a specific student learning need, instructional challenge, student group performance gap • Develop inquiry questions grounded in the identified need
2. Collect and Examine Data
• Gather multiple sources of relevant data (e.g., assessments, observations, student work) • Look for patterns, gaps, and variations
3. Analyze and Interpret Data
• Collaboratively make sense of the data • Explore root causes, equity implications, and underlying factors contributing to the problem or area of focus • Seek to understand why the patterns, gaps, and variations exist
4. Develop and Implement Action Steps
• Design instructional or system changes, interventions, or strategies in response to what the data reveals • Implement these strategies intentionally
5. Monitor and Reflect
• Track progress through new data or observations

- Reflect on whether the changes are having the desired impact
- Adjust plans as needed and continue the cycle

District/School Reflection Questions and Actions

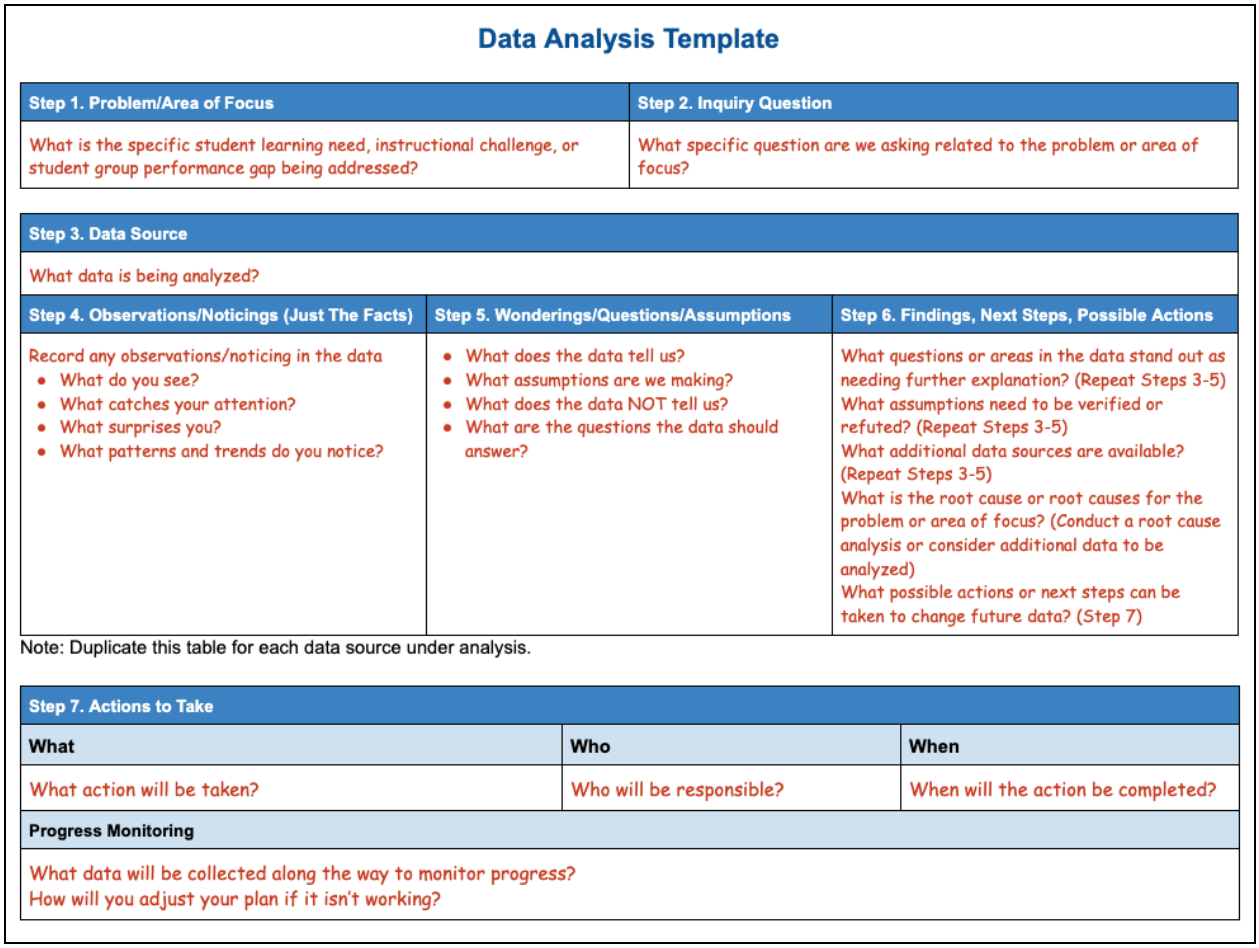
1. Who from your district, school, or organization will be doing the analysis of science data? When assembling a team, consider including people from different roles who can bring diverse perspectives and insights to discussions.
2. How often and for how long will your team meet? Will you meet over a short period of time or across a longer period of time?

Data Analysis Template

A sample Data Analysis Template[40] is available in GoogleDocs for you to use as you conduct your science data analysis (https://bit.ly/ScienceDataAnalysisTemplate). **Figure 2.8** (below) shows what the template looks like. This template may be used as it is or revised based on your specific needs.



40 Link to Template (GoogleDoc): https://docs.google.com/document/d/1Iu37npqd8QxhqdNyGjOJJ-r5d4jRV3UH4I07ZaoIJZU (Bit.ly link: https://bit.ly/ScienceDataAnalysisTemplate)



Data Analysis Template

Step 1. Problem/Area of Focus	Step 2. Inquiry Question
What is the specific student learning need, instructional challenge, or student group performance gap being addressed?	What specific question are we asking related to the problem or area of focus?

Step 3. Data Source		
What data is being analyzed?		
Step 4. Observations/Noticings (Just The Facts)	**Step 5. Wonderings/Questions/Assumptions**	**Step 6. Findings, Next Steps, Possible Actions**
Record any observations/noticing in the data • What do you see? • What catches your attention? • What surprises you? • What patterns and trends do you notice?	• What does the data tell us? • What assumptions are we making? • What does the data NOT tell us? • What are the questions the data should answer?	What questions or areas in the data stand out as needing further explanation? (Repeat Steps 3-5) What assumptions need to be verified or refuted? (Repeat Steps 3-5) What additional data sources are available? (Repeat Steps 3-5) What is the root cause or root causes for the problem or area of focus? (Conduct a root cause analysis or consider additional data to be analyzed) What possible actions or next steps can be taken to change future data? (Step 7)

Note: Duplicate this table for each data source under analysis.

Step 7. Actions to Take		
What	**Who**	**When**
What action will be taken?	Who will be responsible?	When will the action be completed?
Progress Monitoring		
What data will be collected along the way to monitor progress? How will you adjust your plan if it isn't working?		

Figure 2.8: A data analysis template is available in GoogleDocs for teams to use as they conduct their data analysis (bit.ly/ScienceDataAnalysisTemplate)

The steps and questions for the process of analyzing data are summarized in **Table 2.7** (below). Documenting and summarizing the observations, findings, and next steps of the data analysis process will help your team when the time comes to communicate and justify any actions or strategies that should be taken as a result of the data analysis process.

Table 2.7: Data Analysis Template

Step 1. Problem/Area of Focus
• What is the specific student learning need, instructional challenge, or student group performance gap being addressed?
Step 2. Inquiry Question
• What specific question are we asking related to the problem or area of focus?

Step 3. Data Source
• What data is being analyzed? (Review **Table 2.1** for examples of possible student achievement data and **Table 2.2** for examples of local systems data that may be analyzed)
Step 4. Observations and Noticings (Just The Facts)
Record any observations/noticing in the data • What do you see? • What catches your attention? • What surprises you? • What patterns and trends do you notice?
Step 5. Wonderings/Questions and Assumptions
• What does the data tell us? • What assumptions are we making? • What does the data NOT tell us? • What are the questions the data should answer?
Step 6. Findings, Next Steps, and Possible Actions
• What questions or areas in the data stand out as needing further explanation? (Repeat Steps 3-5) • What assumptions need to be verified or refuted? (Repeat Steps 3-5) • What additional data sources are available? (Repeat Steps 3-5) • What is the root cause or root causes for the problem or area of focus? (Conduct a root cause analysis or consider additional data to be analyzed) • What possible actions can be taken to change future data? (Step 7)
7. Actions to Take
• What specific actions will be taken? Who will be responsible? When will the action be completed? • What data will be collected along the way to monitor progress? • How will you adjust your plan if it isn't working?

Root Cause Analysis

Root cause analysis is often used in educational settings to identify the underlying reasons for persistent challenges related to student outcomes, instructional practices, school climate, achievement differences across various student groups, or access barriers that affect certain student groups disproportionately. Instead of just addressing surface-level symptoms (such as performance on the Dashboard), root cause analysis helps educators uncover deep, systemic factors that contribute to these issues. It also helps to develop

sustainable solutions and actions that target the source of the problem to create lasting improvements. **Table 2.8** (below) shows the steps for conducting a root cause analysis.

Table 2.8: Steps for Conducting a Root Cause Analysis

Step 1: Clearly Define the Problem
• Describe what's happening. • Be specific: Who is affected? When and where is it happening? How often?
Step 2: Collect and Analyze Data
• Gather multiple sources of data (refer to **Table 2.1** and **Table 2.2** for possible data sources) • Analyze data (refer to **Table 2.7** for questions to ask when analyzing data)
Step 3: Use Root Cause Tools
• Use a **Fishbone (Cause-and-Effect) Diagram** to organize the range of potential causes for the problem into categories. This is helpful when the problem is more complex and you want to brainstorm all the possible contributing factors. • Use the **Five Whys Protocol** to investigate symptoms and the underlying causes of a specific problem or issue.
Step 4: Identify the Root Cause

• Determine the root cause for action and summarize it as a statement
• Criteria for a root cause statement:
  ○ It directly contributes to the problem
  ○ It is actionable and within the school or district's ability to influence
  ○ It is not just a symptom of another issue

Step 5: Develop Actionable Solutions
• What specific actions will be taken? Who will be responsible? When will the action be completed? • What data will be collected along the way to monitor progress? • How will you adjust your plan if it isn't working?
Step 6: Monitor and Evaluate
• How will you track progress? • What are your short-term and long-term indicators of success? • How will you adjust if the solution isn't working?

Fishbone (Cause and Effect) Diagram

A fishbone diagram, also known as a cause-and-effect diagram, is a visual tool used to systematically identify, explore, and display the possible causes of a specific problem or effect (why something is happening). It looks like the skeleton of a fish, with the problem or effect at the "head" and categorized specific causes as the "bones" branching off the spine. **Figure 2.9** (below) shows an example of a fishbone diagram.

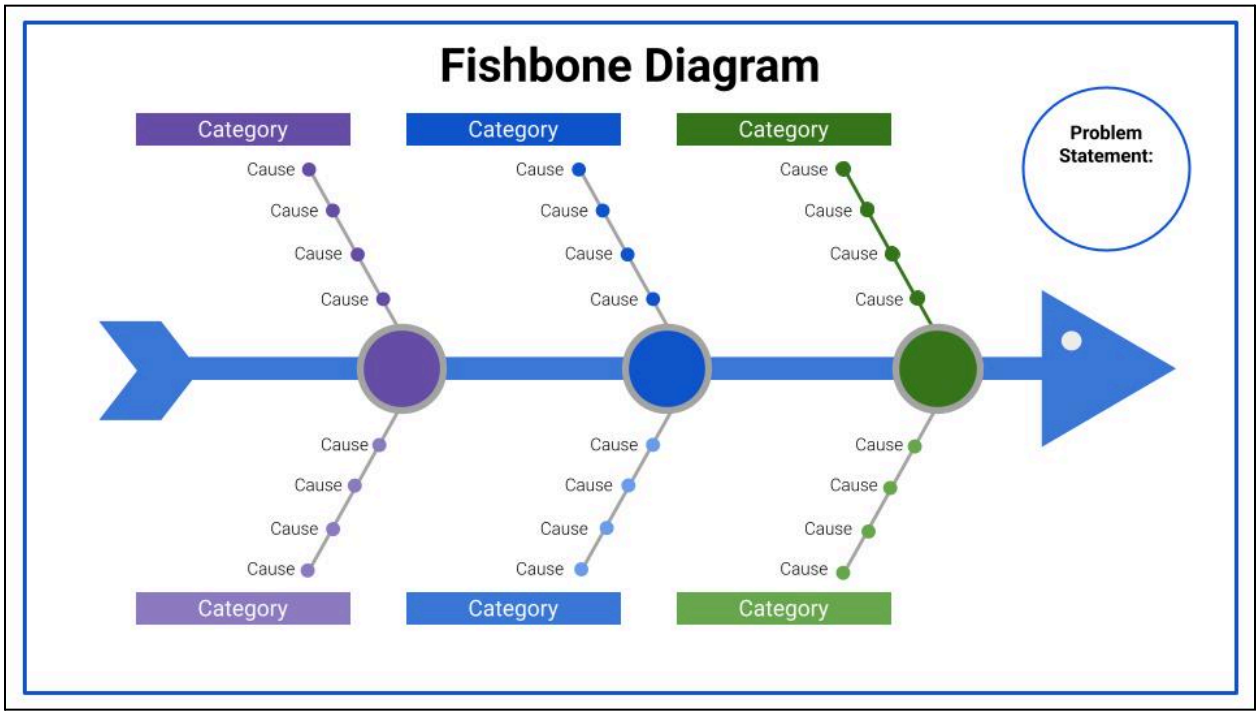


Figure 2.9: Example of a fishbone diagram chart.

Fishbone diagrams help teams brainstorm and organize potential causes into categories to get to the root cause of an issue. They are best used when:

- you need to explore multiple potential causes across categories;
- you are working with a team and want to visually organize group input, insights, and perspectives;
- the problem is complex and you are still trying to understand the broader system.

Table 2.9 (below) outlines some common categories and possible causes that may contribute to student performance and achievement gaps in science. In addition to possible causes for all students, specific examples are also provided for English Learners and Multilingual Learners. This information is provided to support and guide thinking and should not limit a team when conducting a root cause analysis or be used instead.

Table 2.9: Example Categories and Causes for Student Achievement Gaps in Science

Category	Examples of Possible Causes
Instruction and Assessment Practices • Quality of teaching strategies • Use of data to inform instruction • Differentiation for diverse learners • Cultural responsiveness in teaching • Frequency and type of formative or summative assessment	• Limited use of inquiry-based and hands-on science practices • Insufficient integration of crosscutting concepts and scientific practices • Lack of alignment to Next Generation Science Standards (NGSS) • Low use of formative assessment to guide science instruction • Limited scaffolding for complex science texts and tasks • Science assessments not aligned to NGSS or three-dimensional learning • Assessment tasks may not provide language supports for multilingual learners • Limited opportunities for students to show science learning in multiple ways (oral, visual, hands-on) • Heavy reliance on multiple-choice tests rather than performance tasks *Specific examples focused on English Learners (ELs) and Multilingual Learners (MLs):* • *Science instruction does not intentionally integrate language development with content learning* • *Teachers provide limited scaffolds (sentence frames, visual aids, modeling) to support language access in science* • *Overemphasis on vocabulary memorization instead of deep sense-making and conceptual understanding* • *Limited opportunities for ELs and MLs to engage in productive academic talk, writing, and hands-on science using language* • *Instruction often focuses on simplified tasks that do not offer cognitively demanding science learning for ELs and MLs* • *Inconsistent implementation of language-rich, NGSS-aligned practices (e.g., student discourse, phenomena-based learning)* • *Assessment accommodations for multilingual learners are limited or inconsistently applied* • *Heavy reliance on written responses in assessment without opportunities for oral, collaborative, or multimodal explanations*
Curriculum and Materials • Access to rigorous, standards-aligned curriculum • Availability of culturally relevant materials	• Inconsistent access to NGSS-aligned curriculum and high-quality science resources • Limited availability of culturally relevant science examples and phenomena • Outdated science textbooks, lab equipment, or digital tools • Lack of access to real-world, locally connected science

• Language accessibility (translation, reading levels) • Outdated or limited resources	phenomena • Insufficient support materials in multiple languages *Specific examples focused on English Learners (ELs) and Multilingual Learners (MLs):* • *Science curriculum is not fully accessible linguistically to multilingual learners* • *Lack of culturally relevant examples, phenomena, and representations that connect to multilingual learners' backgrounds and assets* • *Limited access to multimodal supports (e.g., visuals, diagrams, simulations, videos, graphic organizers)* • *Science resources and assessments rarely available in students' home languages* • *Curriculum pacing does not allow processing time for complex science concepts and language*
School Structures and Systems • Master scheduling and access to advanced coursework • Placement practices (tracking, interventions) • Availability of support programs (tutoring, counseling) • Resource allocation (staffing, materials, technology)	• Unequal access to regular and advanced science courses (tracking or gatekeeping) • Scheduling conflicts that prevent participation in science courses • Inadequate time allocated for science instruction, especially in early grades • Inconsistent availability of science intervention or support programs • Resource disparities between schools or classrooms (labs, equipment, class size) *Specific examples focused on English Learners (ELs) and Multilingual Learners (MLs):* • *EL and ML students may experience tracking or exclusion from regular and advanced science pathways* • *Pull-out language support services may reduce time spent in core science instruction* • *Lack of targeted supports or interventions in science specifically for multilingual learners* • *Inadequate monitoring systems for science achievement and growth specifically for EL and ML students* • *EL/ML science performance data may not be disaggregated or regularly reviewed for improvement planning*
Adult Expectations and Beliefs • Teacher expectations and implicit bias • Beliefs about student	• Low teacher expectations for certain student groups in science • Limited teacher belief in students' ability to engage in high-level science thinking • Bias in how students are placed or recommended for

potential • Cultural competency of staff • Staff professional learning opportunities	advanced science opportunities • Lack of teacher cultural responsiveness in selecting science phenomena or tasks • Science perceived as less important compared to ELA or math *Specific examples focused on English Learners (ELs) and Multilingual Learners (MLs):* • *Some educators hold lower expectations or have deficit mindsets for EL and ML students' ability to engage in rigorous science learning* • *Teachers may confuse language development needs with science ability gaps* • *Educators may lack training or confidence in supporting multilingual learners in science classrooms* • *Deficit-based assumptions may prevent teachers from leveraging students' home languages as assets in learning science* • *Staff may not consistently create language-rich environments where ML students can demonstrate deep science understanding*
Policies and Leadership • School and district policies (grading, discipline, access) • Leadership decisions that impact resource distribution • Professional learning prioritization • Equity-driven policies (or lack thereof)	• Lack of school-wide or district-wide emphasis on science achievement • Insufficient professional learning in science content and NGSS instructional strategies • Inconsistent assessment systems to monitor science progress • Policy prioritization of ELA and math over science in accountability or scheduling • Leadership focus not consistently supporting equitable science access *Specific examples focused on English Learners (ELs) and Multilingual Learners (MLs):* • *School and district policies may prioritize ELA and math growth for multilingual learners, leaving science under-emphasized* • *Limited leadership focus on integrating language development into science professional learning* • *Policies may restrict EL and ML students' equitable access to regular and advanced science courses and programs* • *Science assessments may not offer linguistic accommodations or multiple means of demonstrating understanding* • *Leadership may not routinely disaggregate science data by language proficiency status to guide equitable decision-making*

Five Whys Protocol

The Five Whys Protocol is a simple yet powerful root cause analysis tool used to uncover the underlying cause of a problem. By repeatedly asking the question "Why?" (typically five times, though the number can vary), teams can move past surface-level symptoms to identify the root cause of an issue.

The Five Whys Protocol is best used when:

- You have identified a specific issue and want to dig deeper into its underlying cause.
- You need a quick, straightforward method to explore causes.
- You want to facilitate collaborative, conversational problem-solving.
- You want to understand what might be driving a problem before deciding on solutions. This often leads you to consider additional data for analysis.
- You want to clarify whether a surface-level issue is actually a symptom of something deeper.

The Five Whys Protocol is less effective for highly complex issues with multiple, interconnected causes, where a tool like a Fishbone Diagram may be more appropriate.

The process for using the Five Whys Protocol is straight forward:

1. State and document the problem clearly.
2. Ask “Why?” and document the answer.
3. Ask “Why?” again and document the answer.
4. Continue asking “Why?” until you have uncovered the possible root cause of the problem.

Some tips to consider when using the Five Whys Protocol:

- Be flexible: Sometimes you may need fewer or more than five “Whys.”
- Focus on the process, not blame: The goal is to fix systems, not people.
- Use with a team: Multiple perspectives strengthen the analysis.
- Document the chain of reasoning: This helps others understand how you arrived at the root cause.

Using Improvement Science Methodology

Improvement science is a disciplined approach to understanding problems within a system and learning what changes may lead to better outcomes. Rather than moving quickly from

a problem to a solution, improvement science encourages teams to first understand the problem, the people experiencing it, and the system that is producing the current results. Teams use data and evidence to investigate how structures, processes, practices, and local conditions may be contributing to a problem of practice.

The data analysis and root cause analysis processes described in this section can serve as an important starting point for improvement science. CAST and Dashboard data may help identify **where** differences in science performance exist, while local systems data, student and educator perspectives, observations, artifacts, and other sources of evidence can help teams investigate **why** those differences may be occurring. Tools such as Fishbone Diagrams and the Five Whys Protocol can help teams develop and refine hypotheses about possible causes. Improvement science builds on this investigation by asking teams to identify specific changes they can test to address those causes.

A common method for testing changes is the **Plan Do Study Act (PDSA) Cycle**. Rather than implementing a new strategy across an entire system at once, teams begin by testing a change on a small scale, gathering evidence, and using what they learn to decide what to do next. Each cycle includes four steps:

1. **Plan:** Identify a specific change to test, determine what you expect will happen, decide where and with whom the test will occur, and identify the evidence you will collect.
2. **Do:** Carry out the test and collect data about what happened.
3. **Study:** Examine the evidence, compare the results with what you predicted, and identify what was learned about the change and the system.
4. **Act:** Decide whether to adopt the change, adapt it and test it again, or try a different change based on what was learned.

PDSA cycles are intended to support learning as well as improvement. A change that does not produce the expected result can still provide valuable information about the problem, the system, or the conditions needed for the change to work. Through repeated cycles, teams can refine change ideas, test them under different conditions, and build greater confidence that a change will lead to improvement before expanding its use. This approach shifts improvement from implementing a solution and hoping it works to learning systematically what works, for whom, and under what conditions.

Resources to Learn More about Improvement Science

- The *CDE Continuous Improvement* webpage has identified several frameworks and needs assessment tools (https://www.cde.ca.gov/sp/sw/t1/continuousimprovement.asp)
- *Learning to Improve: How America's Schools Can Get Better at Getting Better* (https://www.carnegiefoundation.org/learning-to-improve-how-americas-schools-can-get-better-at-getting-better)
- *Carnegie Foundation for the Advancement of Teaching: Basics of PDSA Cycles* (https://www.carnegiefoundation.org/basics-of-pdsa-cycles)
- *Institute for Healthcare Improvement: Model for Improvement* (https://www.ihi.org/library/model-for-improvement)

District/School Reflection Questions and Actions
1. How might you use root cause analysis to identify the underlying causes for challenges related to student performance and achievement in science? 2. How might root cause analysis help ensure that you are taking actions that will have the greatest impact to increase science learning opportunities for all students and to reduce science performance gaps? 3. Conduct a root cause analysis to dig deeper into the possible causes for performance and achievement problems and challenges. Use this process to help determine actions that will have the greatest impact for students, especially those who are underserved.

2.6 Strategies and Actions to Increase Science Performance and Reduce Achievement Gaps

The purpose of taking the time to analyze data is to better understand the overall needs of all students in your system, especially student groups that may be underserved and underperforming. When the root causes for performance differences and achievement gaps are uncovered, strategies and actions can be implemented and monitored to improve student performance and learning. It is important to choose actions or strategies that will directly impact the problem or area of focus that has been identified. See **Section 2.4** and **Section 2.5** for processes and tools to help on how to find and document the problem or area of focus.

Table 2.10 (below) lists sample actions or strategies across five focus areas that can be taken at a district level, school level, or classroom level. This list is not exhaustive and is intended to provide you with ideas for consideration. The team that is tasked with conducting the data analysis may have other ideas based on the needs and priorities of your system. **Section 4: Planning and Supporting Instruction & Assessment** builds on this work by helping you move from identifying opportunities to taking meaningful action.

Table 2.10: Sample Strategies and Action Steps to Increase Student Performance in Science and Reduce Achievement Gaps

Instructional Equity and NGSS-Aligned Quality Instruction

District Actions
• Adopt and monitor implementation of NGSS-aligned curriculum and instructional materials
• Provide targeted professional learning in three-dimensional (3D) science instruction and phenomena-based learning
• Provide ongoing professional learning focused on:
  ○ Culturally responsive science teaching
  ○ Phenomena-based, 3D instruction aligned with the NGSS
  ○ Explicit language instruction to support expression of science content for English learners, multilingual learners, and students with IEPs
• Develop and implement common NGSS-aligned interim/benchmark assessments
• Support district-wide science coaching to improve instructional quality
• Ensure curriculum coherence across grade levels and schools with aligned units, common learning progressions, and shared success criteria
School Actions
• Facilitate PLCs focused on unpacking NGSS standards, establishing learning goals, developing common assessments, and analyzing student work
• Observe science instruction to identify disparities in curriculum, pedagogy, materials, and teacher expectations across student groups
• Conduct NGSS-aligned classroom learning walks using agreed upon look-fors of student engagement and learning
• Provide site-specific PL based on formative and summative science assessment data
• Create collaborative lesson planning time for NGSS-based unit design
• Monitor classroom implementation of three-dimensional learning
Classroom Actions
• Design learning sequences that explicitly build toward NGSS performance expectations
• Integrate daily opportunities for students to engage in the Science and Engineering Practices and Crosscutting Concepts to build understanding of the Disciplinary Core Ideas
• Use phenomena-based instruction to drive sense-making and student inquiry
• Regularly administer NGSS-aligned performance tasks
• Establish and communicate success criteria aligned to NGSS aligned learning targets

Equitable Access and Opportunity for Students

District Actions

- Remove barriers to enrollment in regular and advanced science courses enrollment for underserved students
- Track and disaggregate enrollment and participation data in science programs
- Fund and promote after-school STEM programs targeting underrepresented student groups
- Provide intervention and acceleration opportunities aligned to NGSS
- Ensure transportation and scheduling support equitable access to science opportunities

School Actions

- Review course placement policies and gatekeeping practices to reduce barriers that disproportionately impact students of color, multilingual learners, or students with disabilities
- Ensure all students have access to rigorous science coursework across all grade levels, including elementary school, middle school, and high school
- Monitor course enrollment and science participation by student group
- Actively recruit multilingual learners, students with disabilities, and underrepresented students for advanced courses and STEM activities
- Offer in-school science interventions and flexible learning spaces
- Offer enrichment and intervention opportunities during and after school, such as STEM clubs, science fairs, and tutoring programs targeting underrepresented groups

Classroom Actions

- Scaffold complex science tasks while maintaining grade-level rigor
- Offer differentiated support through small-group instruction and language supports
- Design science activities with multiple entry points for student success
- Provide choice in science activities and assessment options to engage diverse learners
- Provide discourse opportunities and student-to-student interactions for students to build language and understanding, especially for English Learners and multilingual learners

Student Engagement and Relevance

District Actions

- Develop culturally and locally relevant phenomena through teacher input or by curating phenomena from phenomena banks (SDCOE Environmental Literacy Phenomena Bank[41], Wonder of Science[42], Phenomena for NGSS[43], ATLAS[44], or other places)
- Build partnerships with local industries, museums, and universities to enrich science learning
- Provide funding and resources for interdisciplinary, project-based science learning
- Incorporate student voice in curriculum development and resource selection

School Actions

- Organize interdisciplinary, NGSS-aligned science experiences and exhibitions
- Host career days with diverse STEM professionals from the local community

41 https://www.sdcoe.net/ngss/environmental-literacy/environmental-literacy-resources

42 https://thewonderofscience.com/phenomena

43 https://www.ngssphenomena.com/

44 https://www.ngss-atlas.com/

- Survey students to tailor science experiences to their interests and cultural backgrounds
- Engage students in real-world science problems tied to their community
- Support school-wide science events and project showcases

Classroom Actions

- Use culturally relevant local and meaningful phenomena to anchor science instruction
- Incorporate project-based learning and engineering design challenges aligned to NGSS
- Incorporate student voice and choice in science learning to boost motivation and ownership
- Embed diverse scientists and culturally relevant examples in daily lessons
- Connect science learning to real-world problems and student lives
- Honor and elevate home languages as resources for sense-making and demonstration of learning

Family and Community Engagement to Support Science Learning

District Actions

- Develop and translate NGSS-aligned family resources
- Offer district-wide family science workshops and STEM events
- Partner with community organizations to provide science learning beyond the classroom
- Provide guidance to schools on building effective family partnerships in science
- Communicate science curriculum goals and assessment expectations to families

School Actions

- Host multilingual family science nights and student exhibitions where students are encouraged to present in multiple languages, providing appropriate translations and interpreters as needed
- Provide regular, accessible communication on science progress and learning goals
- Involve families in school science events, project celebrations, and STEM days
- Send home science resources that support learning in multiple languages
- Collect family feedback on science instruction and engagement opportunities

Classroom Actions

- Assign take-home science activities/materials that encourage family involvement
- Share NGSS learning targets, assessment rubrics, and student progress with families
- Celebrate science learning milestones with family recognition and communication
- Invite family and community members to speak about science-related careers
- Create family-inclusive science projects that reflect students' home cultures

Data-Driven Continuous Improvement

District Actions

- Develop district-wide NGSS-aligned formative, interim, and summative assessment systems
- Disaggregate assessment and participation data by student groups and science pathways
- Provide training on data literacy and NGSS-aligned assessment interpretation
- Track progress toward district science goals
- Establish science dashboards for progress monitoring and public reporting

School Actions

- Facilitate PLC data cycles focused on analysis of NGSS-aligned student work and assessments to design targeted support for struggling students
- Conduct item analyses of assessments to identify trends and gaps by student group
- Use student performance data to refine instruction and intervention strategies
- Set site-specific growth targets for science achievement
- Share progress reports with leadership teams, families, and staff

Classroom Actions

- Use frequent, standards-aligned formative assessments to identify learning needs and adjust instruction in real time
- Track individual student progress toward NGSS performance expectations
- Provide timely, actionable feedback on science tasks
- Prepare students for assessment formats used on district and state tests
- Analyze and respond to student work as part of ongoing instructional cycles

When choosing strategies or actions and developing plans, four questions should carefully be considered:

1. Does the action/strategy address a root cause for the problem or area of focus under consideration?
2. Is the proposed action/strategy justified by the interpretation of available data?
3. What is the intended impact of the proposed action/strategy?
4. How will the impact be monitored and measured?

Determining actions based on a careful analysis of data using the processes in this section of the field guide is only the beginning of a strategic process of implementing change. In **Section 3: Strengthening Science Within Your System** of this field guide, you will be provided with information on ways the actions you plan to take can be integrated into your system, including suggestions for progress monitoring and ways to evaluate the fidelity of strategy implementation.



District/School Reflection Questions and Actions

1. Based on your analysis of various science data, what possible actions/strategies are you considering?
2. With an action/strategy in mind, answer the following questions:
    a. Does the action/strategy address a root cause for the problem or area of focus under consideration?
    b. Is the proposed action/strategy justified by the interpretation of available data?
    c. What is the intended impact of the proposed action/strategy?
    d. How will the impact be monitored and measured?
3. What next steps will you take?

2.7 Reflection and Call to Action

Analyzing science data is most useful when it leads to a deeper understanding of student experiences, the systems that shape those experiences, and the actions that may improve science learning. The tools and processes in this section can help district and school teams move beyond simply identifying differences in student performance to investigating why those differences may exist and determining what changes may lead to better outcomes.

As you consider next steps for your district or school, use the following actions and questions to guide your work.

Establish a Shared Vision and Goal for Science Learning

Develop a clear picture of the science learning experiences and outcomes you want for all students. Use this vision to provide direction for data analysis and improvement efforts.

Questions to consider:

- What do we want students to experience in science across our system?
- What do we want students to know and be able to do as a result of their science learning?
- What goals will help us determine whether science learning and outcomes are improving for all students?
- How is this vision shared and understood across our district or school?

Build a Team to Lead the Inquiry

Bring together people with different roles, experiences, and perspectives to examine science data and contribute to decisions about improvement.

Questions to consider:

- Who needs to be involved in examining science learning and performance in our system?
- Whose perspectives or experiences may be missing from the conversation?
- How will the team create the time and structures needed to engage in an ongoing inquiry process?

Examine Multiple Sources of Science Data

Use multiple types and grain sizes of data to develop a picture of science learning. CAST and Dashboard data can reveal broad patterns, while local assessment and systems data can help teams understand what students are experiencing within schools and classrooms.

Questions to consider:

- What do our Dashboard, CAST, local assessment, and classroom data reveal about student learning and performance?
- What patterns or differences are evident across schools, grade levels, and student groups?
- What local systems data can help us better understand access, opportunity, participation, and students' experiences in science?
- What additional data or perspectives do we need before drawing conclusions or taking action?

Investigate the System and Possible Root Causes

Use evidence to investigate why identified patterns or performance differences may be occurring. Focus on structures, practices, policies, resources, and other conditions within the system rather than assigning causes to students or individual educators.

Questions to consider:

- What problem or area of focus are we trying to better understand?
- What factors within our system may be contributing to the current results?
- What assumptions are we making, and what additional evidence might confirm or challenge them?
- What root cause or causes appear to be both significant and within our ability to influence?

Identify and Test Actions for Improvement

Select strategies or changes that are connected to the identified problem and supported by the evidence gathered during the inquiry process. When appropriate, begin with a small test of change and use what is learned to refine the approach before expanding implementation.

Questions to consider:

- Does the proposed action directly address an identified root cause?
- What evidence supports trying this action?
- What change do we expect to see if the action is successful?
- How might we test the action on a manageable scale before implementing it more broadly?

Monitor, Learn, and Adjust

Improvement is an ongoing process. Identify evidence that will help determine whether actions are being implemented as intended and whether they are contributing to improved student experiences and outcomes.

Questions to consider:

- What evidence will we collect to determine whether the action is having the intended impact?
- How will we monitor progress for all students and for student groups that have historically been underserved?
- What are we learning as the action is implemented?
- Based on the evidence, what should we continue, change, expand, or stop doing?

The goal of these actions is not simply to respond to a single set of assessment results. It is to establish an ongoing cycle in which district and school teams use evidence to understand their system, identify opportunities for improvement, take purposeful action, and learn from the results.

SECTION 3: Strengthening Science Within Your System

3.1 Introduction

Now that you've explored **Section 2: Analyzing and Interpreting Science Data**, **Section 3: Strengthening Science within Your System** helps you take the next step: strengthening your system conditions that enable a meaningful response.

The purpose of **Section 3: Strengthening Science Within Your System** is to explore the structural considerations that can elevate science as a districtwide priority and ensure all students have access to high-quality, NGSS-aligned learning experiences. To move beyond isolated classroom practices, districts must integrate science directly into their core planning and accountability tools including Local Control and Accountability Plans (LCAPs), School Plan for Student Achievement (SPSAs), and strategic equity initiatives. By utilizing California Science Test (CAST) data from the CA Schools Dashboard, educational leaders can establish science as an essential priority, ensuring equitable course access, language integration, and protected instructional time from transitional kindergarten through 12th grade. Taking these steps begins with a thorough system audit using established frameworks to evaluate leadership capacity, instructional minutes, resource allocation, and existing implementation gaps.

Achieving districtwide consistency across grade levels demands building stable infrastructure alongside targeted leadership support. Districts must establish protected time for science within schedules, foster cross-grade articulation, align high school pathways with the CA NGSS three-course model, and maintain safe lab facilities in compliance with California Ed Code. When implementation varies, analyzing root causes helps leaders diagnose specific breakdowns across skill, knowledge, capacity, motivation, cultural competence, and emotional intelligence. Systems can then sustain high-quality teaching through a multi-tiered professional learning framework that pairs professional learning sessions with job-embedded collaborative practice tailored to the needs of classroom teachers, instructional coaches, administrators, and paraprofessionals.

The Science Indicator on the California School Dashboard creates both an opportunity and a responsibility to ensure science learning is intentionally and strategically supported across your system. Ultimately, long-term progress relies on weaving science into established educational frameworks rather than managing it as a standalone initiative.

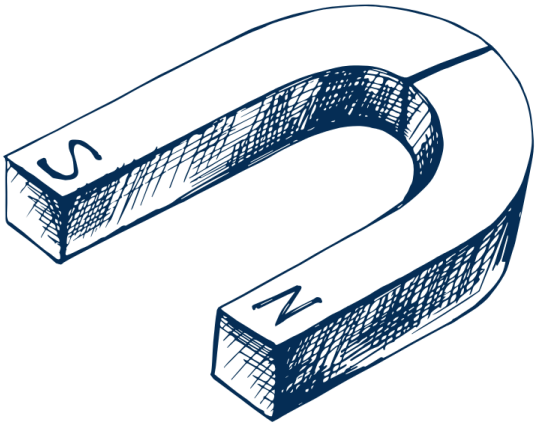
By the end of this section, you will be able to:

1. Identify, strengthen, and sustain the systemwide structures that make science a core part of your district's continuous improvement work.
2. Embed science in district priorities and plans.
3. Audit NGSS implementation and capacity.
4. Ensure instructional consistency from TK–12.
5. Provide robust professional learning.Dark red #a61c00
6. Align science with broader frameworks like Multi-Tiered System of Support (MTSS), Universal Design for Learning (UDL), English Language Development (ELD), and Community Schools.

3.2 Key Concepts & Terms

Here are a few foundational terms that will help you navigate this section.

- **NGSS Implementation -** Coordinated efforts to bring the Next Generation Science Standards into consistent, high-quality classroom practice, supported by aligned district and site systems.
- **LCAP -** Local Control and Accountability Plan; a district's primary tool for setting goals, planning actions, and leveraging resources to meet student needs.
- **SPSA -** Single Plan for Student Achievement; school-site plan connecting goals, actions, and funding to outcomes.
- **MTSS -** Multi-Tiered System of Support; California's whole-child framework for academic, behavioral, and social-emotional supports.
- **UDL -** Universal Design for Learning; a framework for proactively designing instruction to meet the diverse needs of all learners from the outset.
- **Community Schools -** Public schools partnering with families and community organizations to provide whole-child support and expanded learning.



3.3 Recommendations and Implementation Guidance

Align Science Implementation with Broader Educational Goals

Why this matters:
Science has often been sidelined in district improvement plans—seen as secondary to ELA and mathematics or as the domain of specialists. With the California Science Test (CAST) now part of the CA Schools Dashboard and NGSS firmly established as the foundation for instruction and assessment, there is an opportunity to re-establish our commitment to high quality science instruction. To make meaningful progress on the Science Indicator and improve student outcomes, science must be integrated into your system's broader priorities—including the LCAP, SPSAs, and strategic equity initiatives. Embedding science in your system's improvement architecture sends a powerful message: Science matters for every student, and it's everyone's responsibility.

Start by mapping where science already fits into your district plans and where it should. While the LCAP and other district planning tools were always intended to support all content areas, in practice they have heavily emphasized ELA and math. The guide produced by California County Superintendents service Region 10 (Inyo, Mono, Riverside, San Bernardino counties), *Opportunity for Successful Science Implementation in a Post-Pandemic Climate*[45], points out that science's absence is often due to a misconception that LCAP actions must be tightly tied to standardized assessments with a long history of data—leaving science out of the frame despite clear alignment with state priorities.

Key Actions

- Review your most recent LCAP and SPSAs. Are metrics and action steps for "science," "NGSS," "STEM," and/or "environmental literacy" included within your plans and to what extent do existing goals support science instruction?
- Examine district graduation requirements, master schedules, course enrollment demographics, or equity initiatives. Do they support full access to science instruction in TK–12?

[45] *Opportunity for Successful Science Implementation in a Post-Pandemic Climate GUIDANCE PLANNING FOR HIGH QUALITY SCIENCE INSTRUCTION TK–12*. RCOE. https://www.rcoe.us/media/i4mborwh/science-supporting-process-booklet-2023.pdf

Key Actions
• Use this gap analysis to open a conversation with district leadership: *What do we say our goals are and does science show up in how we plan and fund those goals?*

Tools for Connecting Science to LCAP Goals

Use the tools below to identify where science lives in your current plans—and where it might be strengthened.

- **Model LCAP Content for Science.**[46] Includes sample goals, actions, and measurable outcomes connected to state priorities. Example under Priority 2 (Implementation of State Standards): "All teachers will be supported in teaching the NGSS through professional learning, curriculum alignment, and access to instructional materials." Suggested metrics include teacher credentialing, instructional minutes, and classroom observations.
- **Science Guiding Questions for Districts.**[47] Reflective prompts to assess your current vision and infrastructure for science, including: "Does the district have a shared, programmatic K–12 vision for science instruction?" and "In what ways is the district allocating financial resources for NGSS implementation, sustainability, and continuous improvement?"
- **Region 10 Planning Booklet.** Digestible guidance for linking science to equity and accountability measures. Encourages writing science explicitly into the LCAP with references to NGSS, environmental literacy, and STEM/STEAM—and tying science learning to goals for language development, project-based learning, and civic engagement. See also: *Does Your LCAP Support Science for All Students?* by Yamileth Shimojyo[48] and Region 10's science implementation guidance booklet.[49]

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[46] Strengthening Science & NGSS Implementation: Model Content for LCAPs
https://lawrencehallofscience.org/wp-content/uploads/2022/07/Model-LCAP-Content-ScienceNGSS-0916.pdf
[47] Assessing the Need to Build District Capacity to Support Science and Implementation of NGSS
https://lawrencehallofscience.org/wp-content/uploads/2022/07/Science-Guiding-Questions-for-Districts-Science-0916.pdf
[48] *Does Your LCAP Support Science for All Students?* by Yamileth Shimojyo
https://classroomscience.org/articles/fyi/does-your-lcap-support-science-all-students
[49] Opportunity for Successful Science Implementation in a Post-Pandemic Climate GUIDANCE PLANNING FOR HIGH QUALITY SCIENCE INSTRUCTION TK–12. RCOE. 2023 https://www.rcoe.us/media/i4mborwh/science-supporting-process-booklet-2023.pdf

Aligning with equity and college/career goals. Integrating science into LCAPs and other plans isn't just about compliance; it's about coherence. The *Framework for Leading NGSS Implementation*[50] emphasizes that science equity must be central to system design. Districts should ensure:

- Access to science courses and lab experiences for all students, including English Learners, students with disabilities, and foster youth.
- Early exposure to science in TK–5 to build pathways to STEM careers.
- Equitable access to professional learning for educators across grade levels and roles.

Look for alignment with goals like:

- **Graduation pathways and A–G completion:** Does every high school student engage with the full breath of the high school science standards through three years of NGSS-aligned science, including Earth Science as guided by the CA Science Framework: High School 3-Course Model (Ch 7)[51]?
- **Student engagement and connectedness:** Does each and every student engage in CA NGSS aligned science learning opportunities (e.g., phenomena-based instruction)? Where and for which grade levels do interdisciplinary projects occur and how do these projects provide students (and which students) to CA NGSS aligned science learning?
- **Language development and literacy:** Are ELD and ELA literacy standards and strategies integrated into science classrooms? Are opportunities to read, write, speak and listen about science topics integrated into ELD and ELA spaces?

CAST and the Dashboard: using data to drive alignment. The CAST is now reported on the Dashboard alongside ELA and math, including disaggregated student-group data. This creates new opportunities and pressures for science to be included in your district's continuous improvement planning. Use CAST data not just for compliance, but to:

- Identify gaps in access or achievement across student groups.
- Showcase progress in new science initiatives or pathway programs.
- Make the case for investing in science within equity-promoting plans (e.g., MTSS, CSI/TSI supports).

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[50] *Framework for Leading NGSS Implementation.* https://eric.ed.gov/?id=ED581706

[51] *2016 Science Framework: High School Three-Course Model (Chapter 7).* https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter7.pdf

When a student group is 'in the red' on the Science Indicator, you are required to address this in your LCAP. This creates a policy lever for embedding science supports into the system of support and for using Dashboard data to tell a broader story of student success. These system shifts are essential for student groups historically underrepresented in science pathways.

Audit Your System's NGSS Implementation Progress

Why this matters:
You can't improve what you haven't examined. Many systems jump straight into purchasing materials or launching professional learning (PL) without first understanding where their NGSS implementation stands and where it needs to grow. A thoughtful, system-level review provides a critical foundation for aligning actions with outcomes. It helps leaders prioritize next steps, celebrate bright spots, and address persistent gaps in a coherent, strategic way. Rather than relying on anecdotal evidence or assumptions, use structured tools to ask a critical question:

Are we set up to support high-quality science instruction for all students, at every grade level?

Use research-based frameworks to structure the audit. Several well-established tools and frameworks can help California districts assess their NGSS readiness and progress. These resources help identify strengths, gaps, and next steps:

- **NGSS District Implementation Indicators (Achieve*).**[52] Outlines 13 indicators across three categories—*Foundational strategies* (e.g., equity and access, management), *Essential strategies* (e.g., instructional materials, professional learning, school structures), and *Results* (e.g., student outcomes and engagement). Each indicator includes sample actions and implementation conditions. Use as a rubric or checklist to assess system progress.

[52] NGSS District Implementation Indicators
https://www.nextgenscience.org/sites/default/files/NGSS%20District%20Implementation%20Indicators%20-%20FINAL_0.pdf

- **NGSS District Implementation Workbook (Achieve).**[53] A hands-on workbook that guides district leaders through self-assessments and planning exercises across core areas (instructional vision, professional learning systems, materials and assessment, leadership and communication, budgeting and alignment). Includes reflection prompts and templates to build a comprehensive implementation strategy.

  ***Achieve** is a nonprofit education organization that played a lead role in the development of the Next Generation Science Standards (NGSS). The organization supports states and districts in implementing rigorous academic standards through research-based tools, policy guidance, and strategic planning resources.*

Assess core infrastructure and capacity. Strong NGSS implementation is more than teacher practice—it requires system-level structures and leadership. Use questions from the The Lawrence Hall of Science's **Science Guiding Questions for Districts**[54] to examine:

- Does your district have a shared K–12 vision for science instruction?
- Is there a dedicated science lead or leadership team?
- Do administrators and site leaders understand what high-quality NGSS teaching looks like?
- Are instructional minutes, staffing, and materials aligned with NGSS? This is especially important for elementary grades, where science time and materials are often inconsistent across schools.

Connect to district planning and funding. A key reason to conduct an NGSS audit is to inform LCAP development and budgeting. The *Framework for Leading NGSS Implementation*[55] by WestEd recommends aligning this review with broader system planning. This includes:

- Crosswalking NGSS implementation with LCAP goals and equity initiatives.
- Identifying areas of overlap with MTSS, ELD supports, and graduation pathways.
- Ensuring science is represented in internal budget and professional learning calendars. The *Developing District Plans for NGSS Implementation*[56] report offers sample implementation plans, evaluation rubrics, and examples of how districts have embedded NGSS goals into formal planning processes.

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[53] NGSS District Implementation Workbook
https://www.nextgenscience.org/sites/default/files/FINAL%20District%20Implementation%20Workbook_0.pdf
[54] The Lawrence Hall of Science: Science Guiding Questions for Districts
https://lawrencehallofscience.org/wp-content/uploads/2022/07/Science-Guiding-Questions-for-Districts-Science-0916.pdf
[55] Framework for Leading NGSS Implementation. WestEd. 2017.
https://www.wested.org/resource/framework-for-leading-next-generation-science-standards-implementation/
[56] *Preventing Detours and Finding Express Lanes on the Journey to Implement the New Science Standards*
https://k12alliance.org/docs/NGSS-Preventing-Detours-Report-Final.pdf

Include diverse voices in the process. An effective audit should include multiple perspectives—central office leaders, site administrators, teacher leaders, and instructional coaches who work in partnership with families, students, and community members when possible. As described in the Early Implementers evaluation, teams that brought in varied interest holders during their planning phase developed stronger, more durable NGSS plans. Consider:

- Focus groups or surveys of teachers to understand current instructional practices.
- Classroom observations using tools like the *Science Walk-Through Protocol*[57] (page 28) from the Early Implementers.
- Inventorying instructional materials across grade levels and sites.
- Opportunities for family and community engagement in meaningful ways, including Indigenous and Tribal partnerships.

Use what you learn to set coherent goals. After reviewing your current state, develop a focused set of implementation goals that are anchored in the district's broader vision. These goals should be tied to measurable outcomes such as instructional minutes, CAST performance trends, professional-learning access, or teacher support structures. Using your analysis of science data (see **Section 2: Analyzing and Interpreting Science Data**) and audit findings, consider the questions below when setting goals around the following:

- Instructional Time & Access:
    - How much time are students actually receiving NGSS-aligned science instruction, and how does that compare to what's needed to meet standards?
    - Is science instructional time protected in the master schedule, or is it the first thing displaced when ELD/ELA/math intervention blocks expand?
    - Are there disparities in access to science instruction across school sites, grade levels, or student subgroups?
- CAST Performance Trends:
    - What do 3-year CAST trends show by grade band, subgroup, and standard/domain (Life, Physical, Earth/Space Sciences)?
    - Which subgroups show the widest performance gaps, and what root causes (e.g. - access, instructional practice, prior schooling, etc.) might explain them?

[57] *Tools and Processes Used by the California NGSS Early Implementers* https://wested2024.s3.us-west-1.amazonaws.com/wp-content/uploads/2024/07/11165735/resource-next-generation-science-standards-in-practice.pdf

- Professional Learning Access:
    - What percentage of teachers assigned to teach science have received NGSS-aligned professional learning in the past two years?
    - Is professional learning differentiated for elementary generalists vs. secondary science specialists, given their very different needs?
    - What professional learning is available specifically on integrating science with other content areas?
- Teacher Support Structures
    - Do science teachers have access to instructional coaches, PLCs, or content-specific mentors — or is support generalized across subjects?
    - What structures exist for instructional consistency? Are there structures for cross-site collaboration among science teachers, especially at small sites with only one science teacher per grade?

Ensure Systemwide Consistency in Science Instruction from TK–12

Why this matters:
High-quality science learning must be more than a classroom-by-classroom initiative. It must be a districtwide commitment. When districts ensure consistent instructional time, aligned pathways, coherent curricula, and equitable resources across all grade levels, students experience science as a continuous, connected discipline rather than a fragmented series of isolated experiences. Without these systemic supports, gaps in science access and quality tend to mirror and exacerbate existing inequities. This section focuses on building the structures that create a stable and equitable learning environment for all students, from transitional kindergarten through graduation.

Key Structures to Support Consistency and Coherence:

- **Instructional Minutes for TK–5:** In many elementary schools, science is the first subject to be dropped when schedules get tight. Inconsistent access in grades TK-2 disproportionately impacts early learners and undermines their ability to engage with more complex scientific practices in grades 3-5 and beyond. Establish a baseline expectation for hands-on, phenomenon-centered science instructional minutes per week, ensure schedules reflect those expectations, and embed this into LCAPs, SPSAs, and administrator classroom observation protocols. Consider

integrating science with ELA or environmental literacy to maximize instructional time.

- **Graduation Requirements and Science Pathways (6–12):** Review graduation requirements to ensure alignment with the NGSS three-course model (typically Biology, Chemistry, and Physics or Earth/Space Science). Are students on a path to meet both graduation and A-G college entrance requirements? Look for patterns of course placement that may disproportionately steer certain student groups, such as English learners or students with IEPs, into non-college-prep pathways. Expanding dual enrollment or CTE-linked STEM pathways can provide more relevant and rigorous options.
- **Articulation Across Grade Bands:** NGSS is intentionally designed to spiral both skill and concept development over the course of students' instructional experiences in K-12. Curricular coherence across grades is essential to ensure that learning builds over time rather than repeating or skipping key concepts. Establish regular opportunities for teachers to collaborate across elementary, middle, and high school levels. Create or adapt scope-and-sequence maps that define what three-dimensional learning looks like at each stage. Cross-grade PLCs or vertical lesson-study cycles help build a shared understanding of student progression in science.
- **Resource Allocations and Curriculum Support:** Hands-on, NGSS-aligned instruction requires far more than a textbook. Plan for recurring costs such as lab consumables, equipment, field experiences, and digital resources. Consider centralized purchasing of science kits. Ensure schools can order materials in time to support implementation. Assign science coaches/TOSAs equitably and empower them to co-plan, model, and provide feedback.
- **Science Safety**[58]: Equitable access to science includes equitable access to safe learning environments. All students, regardless of zip code, deserve working lab equipment, appropriate chemical storage, safety gear, and protocols aligned with California Ed Code. Conduct regular audits of facilities and safety training, ensuring necessary upgrades are made to maintain compliance and reduce liability. Designate a science safety lead and include lab safety in site walkthroughs and facilities master plans.



[58] *CDE's Science Safety.* https://www.cde.ca.gov/Ci/pl/sciencesafety.asp

Diagnosing gaps that undermine systemwide consistency:

Even when structures are in place, implementation often varies widely. The framework outlined in *Mind The Gap*[59] by Elena Aguilar helps identify why breakdowns happen by categorizing common gaps into six types: *skill, knowledge, capacity, will, cultural competence, and emotional intelligence.*[60]

Type of Gap	Definition	Science-Specific Example
Skill	Technical ability to do the task	A teacher doesn't know how to manage materials during a hands-on investigation.
Knowledge	Conceptual understanding	A leader doesn't understand what phenomenon-based learning should look like.
Capacity	Time, tools, or energy	Teachers lack planning time to prepare for lab-based lessons.
Will	Motivation or value alignment	A principal de-prioritizes science because it's not a tested subject in K–4. A high school guidance counselor discourages students from taking a third year of science because graduation requirements only call for 2 years of science.
Cultural Competence	Awareness of diverse learners' needs	Curriculum doesn't reflect students' backgrounds or home languages.
Emotional Intelligence	Managing emotions/self-awareness	A teacher shuts down when receiving feedback on science instruction.

[59] *Mind the Gap,* Elena Aguilar. 2018 https://share.google/ZP2Qxm2tMUpLwwrFs
[60] *The Key to Working With Adult Learners: Mind the Gap,* Elena Aguilar. 2018 https://www.edweek.org/education/opinion-the-key-to-working-with-adult-learners-mind-the-gap/2018/02

This tool can help leaders understand the root causes of uneven implementation and design **tailored supports**. For example:

- A **skill** gap might be addressed through modeling or instructional coaching.
- A **capacity** gap might require scheduling changes or supply-management systems.
- A **will** gap may need values-based conversations and visible leadership modeling.

Note: The **Mind the Gap** figure illustrates the six domains stacked to support "the ability to take action, to do what we need to do." (See diagram.)

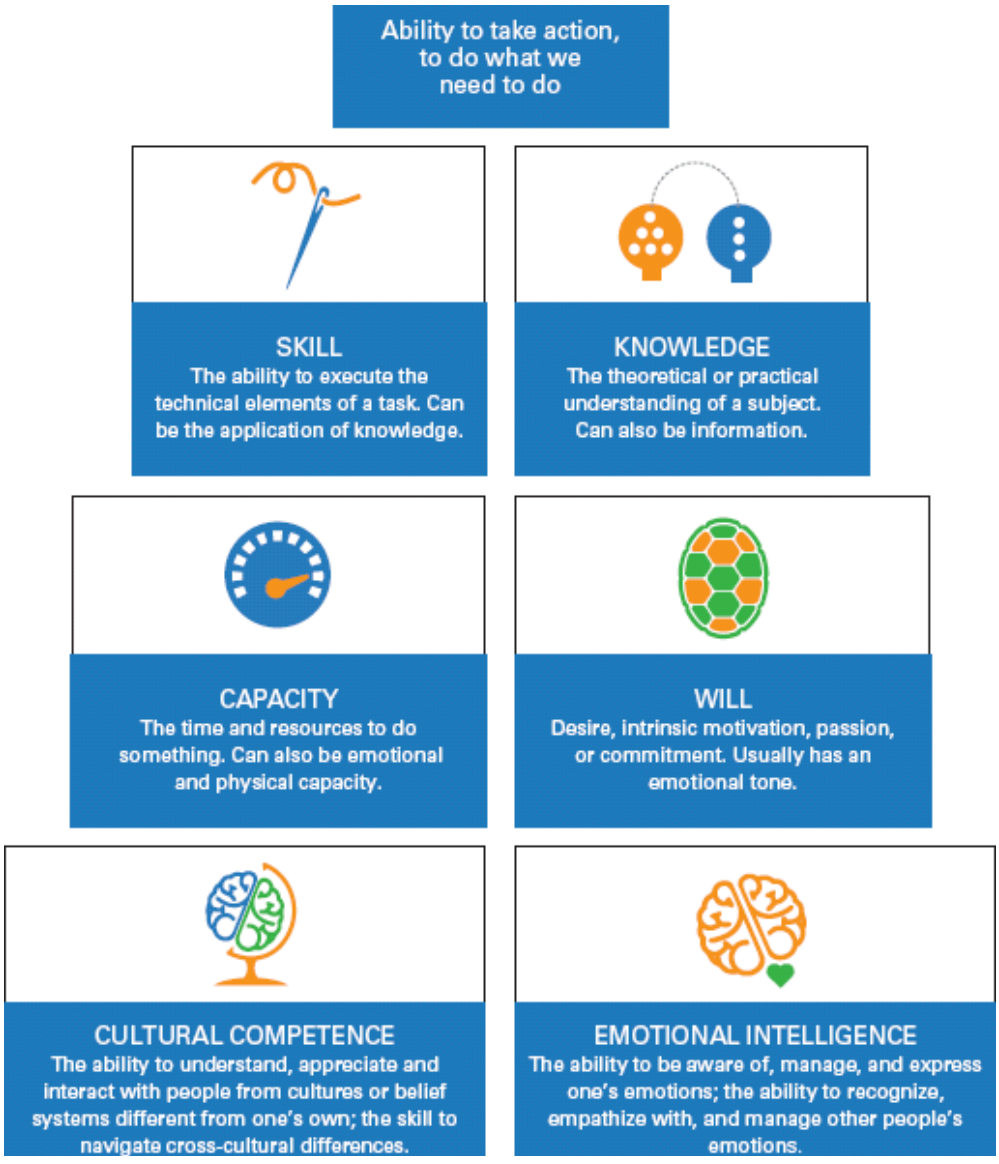


Figure 3.1: Framework of identifying six learning domains (from *Mind the Gap*)

Ensure Your Educators Have Access to High-Quality Science Professional Learning

Why this matters: Research shows that effective professional learning for science—focused on content, pedagogy, and continuous improvement—can increase student achievement and boost teacher confidence in delivering NGSS-based instruction. To translate your science goals into classroom practice, every educator (classroom teachers, paraprofessionals, site educators, instructional coaches, and site leadership/administration) should engage in professional learning that is job-embedded, collaborative, and sustained.

Build a Multi-tiered Professional Learning System

1. **Core Foundational Professional Learning**
   Tap into state-supported resources such as your local County Office of Education or the California NGSS Collaborative[61], a partnership among CDE, CCSESA, California Science Project[62], K–12 Alliance[63], and California Association of Science Educators (CASE)[64] for access to high quality professional learning sessions. These might include sessions and/or coaching on:
   - **Three-Dimensional Learning Mechanics:** PL on integrating Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs) simultaneously within single lessons
   - **Phenomenon-Based Instruction and Storylines:** Guidance on selecting real-world natural phenomena to anchor units, and designing coherent instructional storylines where students actively "figure out" science concepts rather than passively receiving information.
   - **Equity and Accessible Science Pedagogy:** Strategies for using NGSS strategies to support diverse learners, including leveraging rich science discourse for English language acquisition, providing multi-modal access points, and tailoring instruction for special education.
   - **Cross-Disciplinary Alignment**: PL that demonstrates how to align NGSS practices with Common Core State Standards in Mathematics and ELA/Literacy, using science content to build reading comprehension, scientific writing, and quantitative reasoning.

[61] *California NGSS Collaborative. https://sites.google.com/view/cangsscollaborative/home*
[62] *California Science Project. https://californiascienceproject.ucr.edu/*
[63] *K-12 Alliance. https://k12alliance.org/*
[64] *California Association of Science Educators. https://cascience.org/*

- **3D Assessment and Student Work Analysis**: PL focused on building and scoring formative and summative performance tasks, science notebooking, and open-ended items that evaluate multi-dimensional performance rather than rote memorization.

2. **Job-Embedded Collaborative Practice**
   Invest in teacher-centered learning methods such as **Teaching Learning Collaboratives (TLCs)** and **lesson study**, strategies validated by WestEd and early NGSS implementers. These formats:
   - Engage teachers in planning, teaching, observing, and reflecting together.
   - Utilize clear lesson study protocols such as those outlined in the **Virtual Lesson Study Facilitator Playbook**[65].
   - Support instructional shifts toward **phenomena-based, three-dimensional** learning.
   - Scale leadership by training teacher leaders to facilitate TLCs.
3. **Facilitator-Focused Continuous Improvement Professional Learning**
   Use WestEd's **Facilitating Improvement in Teacher Practice**[66] eight-module series, which equips coaches and leaders to guide continuous-improvement cycles (root-cause analysis, prototyping, data review, and peer learning huddles).
4. **Content-Focused Book Study or Resource Deep Dive**
   Organize cohorts around research-based texts (e.g., *A Teacher's Guide to VITAL Collaboration* by Kevin Perks.[67] *Teaching with the Brain in Mind* by Eric Jensen[68]). Use these to build facilitation skills, strengthen PLC structures, and foster teacher efficacy.

Choosing and sequencing Professional Learning strategically. A coherent professional learning system aligns with roles:

Role	Recommended Professional Learning (PL) Experience
Classroom Teachers	Introductory CA NGSS Rollout + year-long TLC/lesson-study cycles + optional VITAL book study

[65] *Virtual Lesson Study Facilitator Playbook.* https://californiascienceproject.ucr.edu/sites/default/files/2021-12/playbook-draft-document_master-v18.pdf
[66] *Facilitating Improvement in Teacher Practice: Professional Learning.* https://www.wested.org/resource/facilitating-improvement-in-teacher-practice-professional-learning/.
[67] Perks, Kevin. *A Teacher's Guide to VITAL Collaboration*. Teachers College Press, 2025. *https://www.tcpress.com/products/Facilitating Improvement in Teacher Practice: Professional Learning – WestEda-teachers-guide-to-vital-collaboration_9780807783047*
[68] *Teaching with the Brain in Mind, 2nd Edition.* ASCD, 2025, *https://www.ascd.org/books/teaching-with-the-brain-in-mind-2nd-edition?variant=104013E4*

Role	Recommended Professional Learning (PL) Experience
Teacher Leaders/Coaches	Collaborative strand + *Facilitating Improvement* modules + lead TLCs + VITAL facilitation PL
Site/District Leaders	CA NGSS Rollouts + CDE's Continuous Improvement Resources & Modules + oversight of PL equity and outcomes
Paraprofessionals & Aides	Targeted cohorts on facilitating investigations, equity practices, and science-literacy supports

Connect Professional Learning to science goals. Ensure that your professional learning system:

- Builds content knowledge and pedagogical understanding, especially around NGSS design and classroom investigation.
- Supports leadership capacity to facilitate and sustain PL beyond initial events.
- Aligns with your system's NGSS goals—whether improving classroom practices, increasing instructional consistency, or boosting CAST performance.

Additional state resources for professional learning:

- California Math, Science, & Computer Science Program (https://www.calmscs.org/science/).
- California Department of Education Science PL and Instruction Resources (https://www.cde.ca.gov/ci/pl/resources.asp),
- California Department of Education Continuous Improvement Resources (https://www.cde.ca.gov/sp/sw/t1/continuousimprovement.asp)
- California Academy of Sciences (https://www.calacademy.org/educators),
- Exploratorium Teacher Institute (https://www.exploratorium.edu/education/teacher-institute)

Align Your Science Goals with Broader Improvement Efforts

Why this matters: District and site leaders are being asked to do more with finite time and resources. The most effective science systems do not treat NGSS as a standalone initiative. Instead, they embed science into broader frameworks for school improvement—leveraging

existing efforts to expand access, improve instruction, and close opportunity gaps. Aligning science with systems like MTSS, UDL, and the California Community Schools Framework[69] creates coherence, strengthens equity, and maximizes impact.

1) Integrate NGSS into Multi-Tiered System of Support (MTSS)

California's MTSS framework[70] is a whole-child approach to education that promotes inclusive academic, behavioral, and social-emotional supports across three tiers of intensity. The Orange County Department of Education's California MTSS Framework[71] website provides a wide variety of resources to support MTSS implementation within LEAs.

What this means in science:

MTSS Tier	For Students	Systemically
Tier 1 (Universal)	All students receive high-quality, NGSS-aligned science instruction—access to grade-level content, hands-on investigations, and discourse-rich classrooms.	In order to support Tier 1 instruction, educators need access to NGSS-aligned, high-quality instructional materials (HQIM), systems of laboratory/investigation materials management across classroom/sites, and sufficient budgets to support purchase of consumable supplies.
Tier 2 (Targeted)	Some students need additional support with science practices or language demands. Examples: small-group work analyzing data sets; sense-making of phenomena with scaffolds	In order to support Tier 2 instruction, educators need access to professional learning on data-based decision making, small group instruction, intervention selection based on student needs, models for how to embed Tier 2 evidence based instructional

[69] *California Community Schools Partnership Program. California Department of Education. https://www.cde.ca.gov/Ci/gs/hs/ccspp.asp*

[70] *Multi-Tiered System of Supports. California Department of Education. https://www.cde.ca.gov/ci/cr/ri/*

[71] *CA MTSS. Orange County Department of Education. https://ocde.us/MTSS/Pages/default.aspx*

	(sentence frames, visual organizers)	practices and scaffolds that complement Tier 1 instruction.
Tier 3 (Intensive)	A few select students require intensive intervention and individualized supports Examples: high dosage tutoring focused on scientific reasoning, embedded literacy strategies, adapted lab experiences	In order to support Tier 3 instruction, educators need access to protected time blocks for intervention, specialized staffing trained in supporting science intervention, instructional materials designed to address skill gaps in science.

How to implement:

- Include science data (CAST, classroom assessments, observation data) in MTSS data teams.
- Ensure interventions include science in addition to math and ELA.
- Provide Tier 2/Tier 3 scaffolds aligned with NGSS performance expectations.
- Involve science coaches or leads in MTSS planning and PL.

By integrating science into MTSS, you normalize science as part of the core academic program—and signal that all students deserve full access to the science practices and content that prepare them for college, careers, and citizenship.

2) Apply Universal Design for Learning (UDL) to Science Instruction

UDL (developed by Center for Applied Special Technology or CAST[72]) supports planning instruction to meet the diverse needs of all learners from the outset. UDL is particularly powerful in science, where students engage with complex ideas through multiple modalities. The UDL Guidelines[73], California Coalition for Inclusive Literacy[74], California UDL Coalition[75], and UDL Journey Guide[76] all provide a variety of high quality resources to

[72] *CAST.* https://www.cast.org/about/
[73] *UDL Guidelines.* https://udlguidelines.cast.org
[74] *California Coalition for Inclusive Literacy.* https://ccil.cast.org/
[75] *California UDL Coalition.* https://www.caudl.org/
[76] *UDL Journey Guide.* https://udl.ccee-ca.org/

deepen your understanding of the mindsets and principles of UDL as well as support implementation across your system.

How to apply UDL in science:

- **Multiple Means of Representation:** Present scientific concepts through text, video, diagrams, simulations, and real-world examples.
- **Multiple Means of Engagement:** Use phenomena that reflect students' lives and communities; offer choice in how students engage with content.
- **Multiple Means of Action and Expression:** Allow students to demonstrate understanding through models, lab reports, discussions, or digital tools.

What UDL looks like in practice:

- A middle-school class studying ecosystems uses a local community garden as a case study (engagement).
- Students access readings at varied Lexile levels and use diagrams to support comprehension (representation).
- Final assessments include a written explanation, video report, or physical model (expression).

Embedding UDL into curriculum planning ensures that NGSS instruction is accessible, inclusive, and equity-centered—especially for English learners, students with disabilities, and other diverse learners.

3) Leverage the California Community Schools Framework
Community Schools partner with families and community organizations to provide whole-child supports (expanded learning, health services, and culturally-sustaining practices). California's Community Schools Partnership Program (CCSPP) encourages deep integration of academics with youth development, family partnerships, and health/wellness systems. Resources from the California Engagement Initiative[77], such as the Community Engagement Initiative Field Guide[78], can support building capacity in schools and communities to work together to improve outcomes for students.

What this means for science: Science education becomes a tool for engagement, empowerment, and community relevance.

[77] *Community Engagement Initiative.* https://californiaengage.org/
[78] *Community Engagement Initiative Field Guide.* https://californiaengage.org/wp-content/uploads/2026/08/CEI-Field-Guide-Interactive.html#framework

Key opportunities include:

- **Expanded Learning:** After-school or summer STEM link to NGSS units (robotics clubs, garden-based science, community science projects).
- **Family Partnerships:** Family science nights, student-led science expos, bilingual science workshops.
- **Integrated Support Systems:** Counselors and social workers include science in support plans, especially for historically underserved students.
- **Place-Based Learning:** Use local environments—watersheds, farms, urban infrastructure—as real-world contexts for investigations.

How to implement:

- Include science goals in community-school planning and funding proposals.
- Partner with your County Office of Education, local STEM professionals, museums, environmental groups, science education partners (K-12 Alliance, CASE, Ten Strands, etc.), and universities.
- Leverage external professional learning to launch a train-the-trainer model: Identify key site(s) and expanded learning staff to attend high-quality science professional learning offered by external providers (e.g., COEs, professional orgs, university partners). These participants can then lead local trainings that connect science to wellness, college/career readiness, and other student support systems. This helps build internal capacity while avoiding the echo chamber of only in-district PL.

By embedding science into the vision and programming of community schools, districts elevate science as a **core component** of student thriving and community empowerment—not an add-on.

Aligning with student-group supports

- **LTELs and English Learners:** Use science as a context for meaningful language development (structured academic talk, rich literacy practices).
- **Students with Disabilities:** Ensure science curriculum is UDL-informed; integrate accommodations into planning from the start.
- **Foster Youth, Homeless Youth, Low-Income Students:** Monitor participation in science courses, clubs, and pathway programs; build connections to community-based supports.

3.4 Spotlight Examples

MTSS in Action for Science - A middle school integrates science into Tier 2 supports by forming small groups to practice data analysis using visual organizers and sentence frames. Science coaches co-design the scaffolds and monitor progress through common formative assessments.

UDL in Ecosystems - A grades 6–8 team anchors an ecosystems unit in a community garden. Students access multimodal texts (diagrams, simulations, short articles at varied Lexiles) and demonstrate understanding by choosing among a written explanation, a short video, or a physical model.

Community Schools, Place-Based Biology - An urban high school partners with a local watershed group. Students collect water-quality data for the biology course, present findings to families at a bilingual science night, and co-design environmental action projects with community mentors.

Science and Language Development for LTELs - An elementary school uses NGSS-aligned investigations to support Long-Term English Learners (LTELs). During a unit on weather patterns, students engage in structured academic talk using sentence stems and visual models. Teachers co-plan with ELD specialists to embed language objectives into science lessons, turning hands-on investigations into rich opportunities for oral and written language development.

3.5 Reflection and Call to Action

Strengthening system conditions for science is essential for transforming both state and local science data into meaningful, sustainable improvements in classroom practice. This work is most effective when it leads to a deeper alignment with district priorities, coherent TK–12 learning pathways, and equitable access for all students. The strategies and guidance in this section can help district and school teams move beyond treating science as an isolated subject to embedding high-quality NGSS aligned instruction into core planning, infrastructure, professional learning, and whole-child improvement frameworks.

As you consider next steps for your district or school, use the following actions and questions to guide your work.

Embed Science into Core District Priorities and Strategic Planning

Integrate science explicitly into LCAPs, SPSAs, and strategic equity initiatives to ensure dedicated resources, clear accountability, and shared ownership across all grade levels.

Questions to consider:

- How is science explicitly represented within your district's current LCAP, SPSAs, and funding plans, and what strategic adjustments are needed to ensure science instruction is prioritized alongside ELA and mathematics?
- How are CAST performance trends and Dashboard data leveraged to justify resource allocation and drive targeted actions in local planning, especially for student groups performing at the Red performance level?

Audit System Readiness and Infrastructure Capacity

Evaluate current instructional minutes, staffing, resources, and leadership capacity using established frameworks to identify systemic strengths and operational gaps.

Questions to consider:

- What mechanisms and research-based frameworks will your team use to audit K-12 NGSS implementation, and how will you ensure diverse perspectives—including classroom teachers, site leaders, coaches, and families—are included in evaluating system readiness?
- How do actual science instructional minutes, materials allocations, and support structures compare across school sites and grade levels, and what capacity or scheduling barriers must be addressed to protect instructional time?

Ensure Systemwide Consistency, Safe Environments, and Root Cause Diagnostics

Establish coherent course pathways, protected instructional time, safe lab facilities, and diagnostic tools to address variations in implementation across classrooms and sites.

Questions to consider:

- How well aligned are your middle and high school course pathways with the NGSS 3-course model and A–G requirements, and how do site facilities and safety protocols comply with California Ed Code across all campuses?
- When science implementation varies across sites or grade bands, how will leaders diagnose the root cause—whether rooted in skill, knowledge, capacity, will, cultural competence, or emotional intelligence—to provide targeted, differentiated support?

Establish a Sustained, Multi-Tiered Professional Learning System
Deliver job-embedded, role-specific professional learning that builds educator efficacy, strengthens pedagogical content knowledge, and fosters continuous collaborative improvement.

Questions to consider:

- How is professional learning structured across roles (classroom teachers, TOSAs/coaches, administrators, and paraprofessionals) to move beyond one-time workshops into job-embedded, collaborative cycles such as Teaching Learning Collaboratives (TLCs) or lesson study?
- How does your professional learning strategy build content knowledge, phenomena-based instructional practices, and leadership facilitation skills to sustain continuous improvement in science across grade levels?

Integrate Science into Broader Systems of Support (MTSS, UDL, and Community Schools)

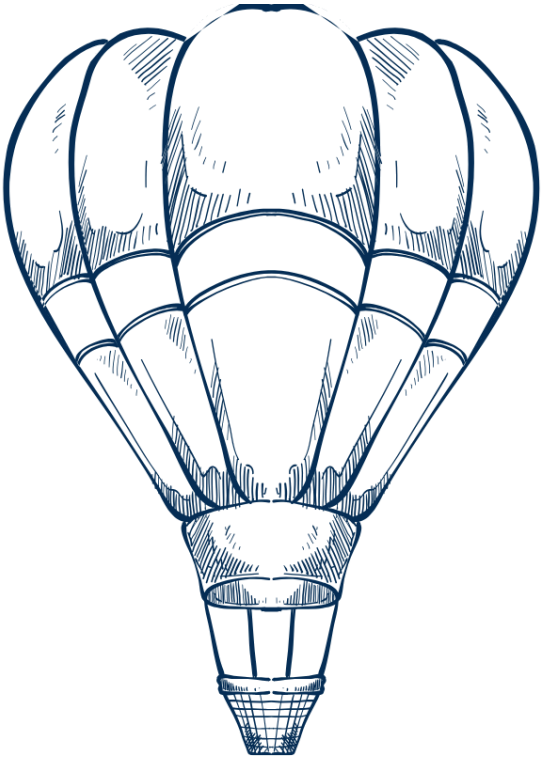
Connect science instruction to Multi-Tiered Systems of Support (MTSS), Universal Design for Learning (UDL), English Language Development (ELD), and Community Schools initiatives to maximize accessibility, equity, and community relevance.

Questions to consider:

- How is science instruction integrated into your system's MTSS framework (across Tiers 1, 2, and 3) and UDL practices to ensure English learners, students with

disabilities, and historically underserved student groups have full access to rigorous, grade-level science learning?
- What opportunities exist to connect science learning with Community Schools initiatives, place-based learning, expanded learning programs, and local community partnerships to elevate student engagement and real-world relevance?

The goal of strengthening these system conditions is not merely to check off implementation metrics. It is to build a robust, sustainable infrastructure that elevates science learning across all schools and ensures every student experiences three-dimensional, equitable, high-quality science education. In **Section 4: Planning and Supporting Instruction & Assessment** of this Field Guide, you will build on these system structures by exploring strategies to measure impact, monitor continuous improvement, and refine practices over time.



SECTION 4: Planning and Supporting Instruction & Assessment

4.1 Introduction

Now that you've explored **Section 3: Strengthening Science within Your System**, **Section 4: Planning and Supporting Instruction & Assessment** helps you take the next steps grounded in the belief that all your students can make sense of complex scientific ideas.

The purpose of **Section 4: Planning and Supporting Science Instruction & Assessment** is to highlight instructional strategies grounded in the belief that all students can make sense of complex science ideas. Through this section, you will learn how to increase equitable access to high-quality science education for every learner from transitional kindergarten (TK) through high school, while shifting your classroom dynamics away from teacher-led facts toward active, three-dimensional learning driven by real-world phenomena. You will find guidance on implementing adopted NGSS-aligned curricula and building a balanced, reflective assessment system—utilizing short-, medium-, and long-cycle tools—that mirrors the deep thinking measured by the CAST. **Section 4: Planning and Supporting Instruction & Assessment** empowers you to use data for continuous, equity-centered improvement and to establish growth-centered classroom observation systems that support teacher development and foster lifelong curiosity in your students.

As stated in *A Framework for K-12 Science Education*,[79] the National Research Council (NRC) (2012) identifies four guiding principles about how students learn science:

1. Students are more likely to understand and use ideas when they have had concrete and relevant experiences to draw upon.
2. Students come to school with preexisting ideas about how the world works.
3. Learning is an active process.
4. Learning is maximized when students actively apply new ideas after being introduced to them.

Ideally, these shifts will cultivate an appreciation for the natural world by enthusiastically communicating science as an inspiring, multi-faceted process of discovery that encourages lifelong learning, and fosters critical thinking skills in all students.

[79] https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts

Access:

The first step in supporting science instruction is ensuring access for every student in California. *Call to Action for Science Education: Building Opportunity for the Future*[80] advocates that high-quality science instruction must begin in kindergarten. It is not sufficient for students to only read and write about science. The NGSS performance expectations call for active three-dimensional learning focused on the Science and Engineering Practices and Crosscutting Concepts, not solely the Disciplinary Core Ideas. Providing students opportunities to only read and write about science topics is a reductionist approach to the teaching and learning of science, just as having students only read and write about the history of math and mathematical discoveries would not teach students *how* to do math.

California's *Preschool Through Kindergarten Learning Foundations: Science Domain*[81] emphasizes that "ensuring students spend sufficient time learning science each week is essential. Even the youngest children are capable of engaging in science investigations. Making science a fundamental part of K–5 instruction leverages their natural curiosity about the world. In addition, science provides a rich context for building competencies in mathematics and English/Language Arts and for developing language." Young learners can build foundational science understandings and practices in early childhood settings. These foundations are further supported by California's *P–3 Alignment Learning Progressions for Science*,[82] which clarify how children's understanding of scientific phenomena develops across the early grades and help bridge early learning with the NGSS expectations in elementary school.

"Ensuring students spend sufficient time learning science each week is essential. Even the youngest children are capable of engaging in science investigations."

- *California's Preschool Through Kindergarten Learning Foundations: Science Domain*

The focus on access extends into secondary learning, when all students need access to the full range of science courses (biology, chemistry, physics, and Earth and space science) and advanced coursework such as Advanced Placement, International Baccalaureate, Career and Technical Education pathways, or dual enrollment programs.

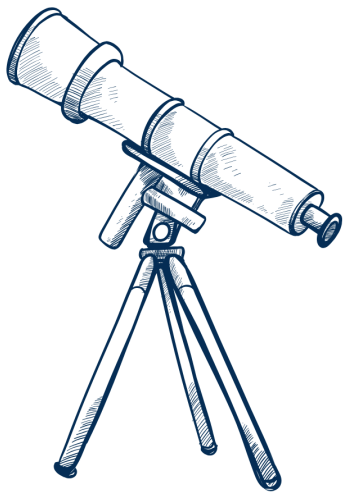
[80] https://nap.nationalacademies.org/catalog/26152/call-to-action-for-science-education-building-opportunity-for-the
[81] https://www.cde.ca.gov/sp/cd/re/documents/ptklfsciencedomain.pdf
[82] https://www.cde.ca.gov/ci/gs/p3/documents/p3learnprogressionssci.pdf

It is important to underscore that science learning is essential in every grade. The 42 Disciplinary Core Ideas, 8 Science and Engineering Practices, and 7 Crosscutting Concepts of the NGSS are intentionally designed to grow in complexity across each grade band: K–2, 3–5, middle school, and high school. Read more in Appendix 1[83] of the California Science Framework.

The California Science Test (CAST) is first administered in fifth grade and assesses students' understanding of the Performance Expectations within the 3–5 grade band. However, students do not begin developing this understanding in third grade. Each grade band builds upon the knowledge, skills, and ways of thinking developed in previous years, making science learning in K–2 foundational. Providing students with meaningful opportunities to explore phenomena, ask questions, investigate, and make sense of the world in the earliest grades establishes the foundation they need for increasingly complex science learning in later grades and ultimately for success on the CAST and beyond.

Equity:
After ensuring access, cultivating classroom communities in which all students are invited and encouraged to engage in the work of science is essential. The National Research Council's, *A Framework for K-12 Science Education* emphasizes the importance of engaging students in all the Science and Engineering Practices to address real world problems that are locally relevant.

A Blueprint for Action for Equitable K-12 Science Education in California[84] advocates for instructional strategies that support the brilliance of every student. Classroom educators, site and district level administrators, and support staff within the school setting need to create culturally affirming environments that foster students' belonging to learn and achieve. "California's students need to see themselves, their cultures, and their everyday lives reflected in science instruction." The California Department of Education's Culturally and Linguistically Responsive Teaching[85] and Culturally Sustaining Pedagogy[86] pages offer resources that help leverage the strengths that students bring to the classroom to make learning more relevant and effective.



[83] https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf
[84] https://drive.google.com/file/d/1VCE2E0L_J-NnuO_3-Rz2nx8kMMbDoqk6/view
[85] https://www.cde.ca.gov/ci/pl/responsiveteaching.asp
[86] https://www.cde.ca.gov/ci/pl/culturallysustainingped.asp

By the end of this section, you will be able to:
1. Identify key instructional and assessment shifts needed to meet the expectations of the Science Indicator and create life-long, curious critical thinkers. 2. Implement practices that reflect the vision of the California NGSS Framework and support improved CAST outcomes. 3. Support classroom and site-level continuous improvement using evidence-based classroom observation tools and instructional look-fors.

4.2 Key Concepts & Terms

Here are a few foundational terms that will help you navigate this section.

- **Instructional Shifts (NGSS):** Classroom practices that shift from teacher-led, fact-based instruction to student-centered, three-dimensional learning grounded in real-world phenomena.
- **Three-Dimensional Assessments:** Assessments that integrate Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs) as outlined in the NGSS.
- **Implementation:** Consistent and accurate use of adopted curriculum and instructional materials to meet the learning needs of all students.
- **Sense-making:** Sense-making is a dynamic process of building or revising thinking in order to "figure something out."
- **Short-, Medium-, and Long-Cycle Assessment:** Terms introduced in Section 2: Analyzing and Interpreting Science Data to describe the frequency and function of assessments from daily classroom use to annual standardized testing.

4.3 Recommendations and Implementation Guidance

Strengthening science education requires more than individual classroom efforts. It requires intentional, sustained investment in science across the TK–12 system. The recommendations and guidance in this section are informed by the California Association of Science Educators' Strategic Investment in TK-12 Science[87] and are intended to support

[87] https://classroomscience.org/articles/spotlight/strategic-investment-tk-12-science-what-it-and-why-it-matters

leaders in prioritizing the conditions, resources, professional learning, and structures necessary for high-quality science learning. Together, these recommendations emphasize that science should be treated as an essential component of a well-rounded education, with equitable access to meaningful science learning for every student, in every grade.

Support High-Quality, Student-Centered Science Instruction

High-quality science instruction grounded in the CA NGSS remains essential for meaningful student learning. Professional Learning should focus on reinforcing and sustaining instructional practices that reflect the vision of the CA Science Framework. Chapter 11: Instructional Strategies for CA NGSS Teaching and Learning in the Twenty-First Century[88] of the framework highlights the following instructional shifts that represent the evolution of science teaching in California.

Implement Student-Centered Learning Environments

Focus on shifting the classroom dynamic from teacher-directed activities to an environment where student ideas and questions drive instruction.

- **Engage students in the Science and Engineering Practices (SEPs):** Students must actively engage in the science and engineering practices to deepen their understanding of content, make sense of phenomena, and design solutions, rather than simply receiving information presented by the teacher.
- **Integrate content and practices:** Science content and the SEPs should be integrated and taught together, as opposed to being taught in isolation.
- **Vary the learning setting:** Routinely conduct learning in a variety of environments beyond the traditional classroom, such as outdoors, in school gardens, museums, aquariums, and the community.

Use inquiry-based, constructivist lesson sequences

Drawing on the key findings of *How People Learn II: The Science and Practice of Learning*,[89] structure lessons so students have opportunities to make sense of ideas before formal instruction, connect their new learning to prior knowledge, and apply and extend their understanding in meaningful contexts.

[88] https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter11.pdf
[89] https://www.nationalacademies.org/projects/DBASSE-BBCSS-13-06

- **Engaging students' prior knowledge is critical to learning:** Begin with piquing student curiosity and elicit their prior knowledge and ideas about a topic.
- **Organizing knowledge into conceptual frameworks is essential in developing scientific understanding**: Provide students with a common base of experiences through active investigation before any formal instruction. Facilitate student explanation following exploration.
- **Learning to monitor one's own thinking and understanding is essential in learning to think like a scientist:** Students should have opportunities to generate their own explanations and designs, connect prior knowledge to new discoveries and use models to communicate their conceptual understanding. Promote application of knowledge and skills to novel situations or new phenomena, providing students opportunities to transfer their learning, develop a broader understanding, and refine their conceptual models.
- **Culture fundamentally shapes all aspects of learning:** Students' experiences and cultural influences shape their understanding of their world and how they learn. Students bring these cultural perspectives into the classroom environment. Create an optimal learning environment to support the productive variation of unique perspectives, strengths, and skills among learners.
- **An individual's motivation, goals, beliefs, values, interests, and identities play an integral role in learning:** Engage students in directing their own learning by providing targeted feedback and support in developing metacognitive skills. Assessment is a critical tool for advancing and monitoring students' learning in school.

Employ Culturally-Sustaining Science Teaching Practices

CDE states, "Culturally Sustaining Pedagogy promotes equality across racial and ethnic communities and seeks to ensure access and opportunity." Read more on the CDE Culturally Sustaining Pedagogy[90] page. In science, you can create more meaningful and equitable learning experiences when you recognize students' cultural knowledge, lived experiences, languages, identities, and ways of making sense of the world as assets for learning. You can invite students to connect science ideas to phenomena that are relevant to their communities and experiences while maintaining high expectations for engaging in the practices of science.

[90] https://www.cde.ca.gov/ci/pl/culturallysustainingped.asp

- **Focus lessons on observable phenomena:** Select big science ideas that are embedded in observable phenomena, which students should use evidence to explain and justify.
- **Elicit and use student thinking:** Actively elicit students' current thinking and emerging ideas about the phenomenon, recognizing these as resources for subsequent learning.
- **Press for causal explanations:** Require students to provide causal explanations of phenomena that include evidence and involve the development of conceptual models and representations (like drawings, diagrams, or simulations).

Design for Deep Cognitive Engagement

Ensure instructional tasks require students to engage with intellectual challenges at a grade appropriate level, promoting deeper, transferrable understanding.

- **Aim for high Depth of Knowledge (DOK) levels:** Instruction should target DOK levels 3 (Strategic Thinking) and 4 (Extended Thinking), using DOK levels 1 (Recall) and 2 (Skill/Concept) as a foundation or bridge to deeper thinking.
- **Require active application of ideas:** Instructional strategies should help students actively apply new ideas to novel contexts, forcing them to revisit, revise, and connect their mental models (the "use it or lose it" principle).
- **Challenge preconceptions:** Provide opportunities for students to recognize when their preexisting ideas fail to explain what they actually observe, leading them to discover and adopt alternative, better-working ideas.

Integrate real-world problems and engineering

Design challenges as the context for learning, explicitly integrating the three dimensions of the standards.

- **Start with a real-world problem:** Introduce an authentic, challenging problem or project at the beginning of a unit to serve as the motivation for all subsequent learning.
- **Integrate all three dimensions:** Ensure the problem requires students to apply scientific concepts and Crosscutting Concepts (CCCs) to support their engineering solutions, such as requiring them to draw models of a system or write explanations.
- **Embrace the pedagogy of failure:** Create a classroom environment that recognizes errors and uncertainties as inevitable features of problem-solving, allowing students to make mistakes and view errors as learning opportunities.

These practices center students as sense-makers and problem-solvers, engaging them in real-world investigations, collaborative reasoning, and interdisciplinary thinking. Engaging in science sense-making includes opportunities for both oral and written discourse. Science talk and science notebooks can be used to foster these routines and serve as formative assessment tools as well.

Related Resources:

The resources below provide additional guidance and support for strengthening science learning across all grade levels. These resources can help you deepen educator understanding of the NGSS and identify opportunities to support coherent, meaningful science learning that builds from year to year.

- Ambitious Science Teaching[91] supports students in tackling authentic and meaningful science phenomena with attention to students' histories, social interactions, and local and global communities. Ambitious teaching requires that teachers develop deep commitments to student learning and a historical understanding of inequity in science and schools. Classroom Examples: Supporting divergent thinking & revising models[92] provides examples of how modeling and explanations in elementary classrooms with neurodivergent thinking. Ambitious teaching takes practice. This website provides resources to develop a vision of ambitious science instruction for today's complex TK-12 classrooms, professional learning, and teacher education.
- NextGenScience at WestEd uses the EQuIP Rubric for Science[93] to identify Quality Examples of NGSS Designed Lessons and Units.[94] The lessons and units identified as high quality by this project can be used to support high-quality science teaching and learning.
- Doing and Talking Math and Science (WIDA)[95] are a set of resources developed with experts in math and science education and participating classroom teachers. These resources are designed to support multilingual learners' participation in reasoning-centered, discourse-rich classrooms.

[91] https://ambitiousscienceteaching.org/
[92] https://ambitiousscienceteaching.org/wp-content/uploads/2023/11/Model-Revision-stories.pdf
[93] https://www.nextgenscience.org/resources/equip-rubric-science
[94] https://www.nextgenscience.org/resources/examples-quality-ngss-design
[95] https://stem4els.wceruw.org/index.html

- STEM Teaching Tools[96] has tools that can help educators teach science, technology, engineering and math (STEM). Each tool is focused on a specific issue and leverages the best knowledge from research and practice.
- *The Elements: Transforming Teaching through Curriculum-Based Professional Learning*,[97] Challenge Paper from Carnegie Corporation of New York that explores how professional learning anchored in high-quality curricular materials can allow teachers to experience instruction as their students will, change instructional practices, and lead to better student outcomes.
- *Supporting English Learners in STEM Subjects*[98] from The National Academies, highlights the wealth of resources English learners (ELs) bring to science, technology, engineering, and mathematics (STEM) learning. This report addresses the factors that affect ELs' access and opportunity to rigorous, grade-appropriate STEM learning.
- Building Thinking Classrooms[99] provides a framework for creating learning environments where students actively think, collaborate, problem-solve, and make sense of ideas rather than simply receive information. While originally developed for mathematics, the practices of including rich tasks, making student thinking visible, using random grouping and vertical non-permanent surfaces, can be used in science classrooms as students investigate phenomena and engage in science and engineering practices.

Indicators of High-Quality Science Instruction as outlined in Chapter 11[100] of the CA Science Framework[101]

Indicators of High-Quality Science Instruction
Students engage with science and engineering practices to make sense of phenomena and design solutions.
Student modeling, productive discourse, and science notebooking are routine
Students engage with relevant, real-world learning in which they must investigate and problem solve using critical thinking in an iterative collaborative process

[96] https://stemteachingtools.org/
[97] https://www.carnegie.org/our-work/article/elements-transforming-teaching-through-curriculum-based-professional-learning/
[98] https://www.nationalacademies.org/projects/DBASSE-BOSE-16-01
[99] https://www.buildingthinkingclassrooms.com
[100] *Teaching and Learning*. https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter11.pdf
[101] https://www.cde.ca.gov/ci/sc/cf/cascienceframework2016.asp

Indicators of High-Quality Science Instruction
Students engage in engineering design across all disciplines
Students investigate, experiment, and revise their thinking through hands-on learning and technology
Crosscutting concepts support deeper, connected understanding
Teachers facilitate learning through purposeful questioning, co-construction of understanding, and access to diverse learning environments (e.g., classrooms, gardens, museums, community spaces)
Literacy is embedded through purposeful reading, writing, and communication about science with reasoning and argumentation playing a central role in labs and text
Student-to-student discourse is productive, using practices to explain phenomenon or solve problems
Teachers use questioning prompts and facilitate student discourse and thinking routines

Key Takeaway: Support High-Quality, Student-Centered Science Instruction
Students thrive when instruction reflects the core principles of the CA NGSS. Districts and schools must ensure this kind of instruction is not left to chance, but intentionally designed to support teachers through clear expectations, dedicated instructional minutes, collaboration time, and sustained professional learning. Intentionally creating space and time for teacher collaboration around instructional design and coordinating systemwide efforts, such as protecting instructional minutes and aligning curriculum tools is essential.

Implement High-Quality, NGSS-Aligned Instructional Materials

High-quality NGSS-aligned instructional materials are already available in many districts, but without consistent implementation it rarely delivers on its potential. Supporting implementation with fidelity does not mean rigid adherence to pacing guides or scripts, it means teaching the materials as designed; with any hands-on materials provided; using the embedded sense-making routines; assessing through performance tasks embedded in learning (PTELs); and using three-dimensional (3D) learning experiences as core

instructional drivers. It is especially important to not disrupt coherence when any decisions are made to augment materials.

As a leader, your role is to:

- Ensure NGSS-aligned instructional materials are consistently in use across classrooms, beginning with TK.
- Build protected time for teachers to attend high-quality, sustained professional learning
- Schedule protected time for teachers to plan and reflect on NGSS instruction and prepare for material use.
- Support administrators to look for key aspects of high-quality science teaching and NGSS implementation during classroom observations.

Teachers should not be expected to design NGSS 3D instruction from scratch. Your support in helping them "teach what they have" well is often the fastest path to instructional improvement.

Consider learning more from these related resources:

The California Next Generation Science Standards Toolkit for Instructional Materials Evaluation (CA NGSS TIME)[102] supports and guides the selection of high-quality science instructional materials. CA NGSS TIME is an intentional, articulated, and comprehensive embedded professional learning process that aids in the selection of instructional materials that are phenomenon-based and incorporate three-dimensional learning requires that educators engage in a thoughtful, collaborative, and evidence-based process to ensure success for all California students. California County Superintendents Educational Services Association (CCSESA), now known as "California County Superintendents" (CCS) approved the CA NGSS TIME in November 2018.

The CA NGSS TIME was adapted from the national NextGen TIME,[103] which provides tools and processes to support teams of educators in evaluating the quality of new instructional materials or the quality of current instructional materials. This curriculum-based professional learning positions districts and schools to better leverage the significant investment in instructional materials.

[102] https://sites.google.com/view/cangsscollaborative/ca-next-generation-toolkit-for-instructional-materials-evaluation?pli=1
[103] Biological Sciences Curriculum Study. *Toolkit for Instructional Materials Evaluation* https://bscs.org/nextgentime/

Key Takeaway: Implement High-Quality NGSS-Aligned Curriculum

High-quality instruction starts with consistent use of the adopted NGSS curriculum as designed—not re-creating lessons from scratch. Leadership support, planning time, and administrator training are essential for success.

Site leaders organize and facilitate non-evaluative classroom observations to gather evidence of the fidelity of curriculum implementation and how the materials are serving students.This includes embedding clear "look-fors" that emphasize student-centered, three-dimensional (3D) instruction, as well as providing sustained professional learning that deepens teachers' content knowledge and instructional expertise through modeling, co-planning, and opportunities for reflection.

Align Formative and Summative Assessments to the NGSS

As described in Section 2: Analyzing and Interpreting Science Data, a balanced assessment system includes:

- **Short-cycle:** Classroom discussions (partner, small group, whole group), written responses in science notebooks, exit tickets, and other formats.
- **Medium-cycle:** Unit-based PTELs, benchmarks, CAST Interim Assessments (IAs) (starting in grade 3)
- **Long-cycle:** CAST results (see Section 2.3–2.4).

These assessments should mirror the depth of thinking and application of skills that the grade level performance expectations expect students to demonstrate. This includes designing and using the following:

- Formative assessments that inform instruction in real time.
- PTELs that integrate all three dimensions.
- Medium-cycle assessments (e.g., benchmarks) that provide feedback on progress toward performance expectations.

Before reviewing or approving assessments, sites and districts should establish a shared, evidence-based definition of "aligned", grounded in resources like the Task Annotation

Project in Science (TAPS)[104], so that three-dimensional design drives assessment creation and evaluation.

For classroom-embedded and locally-developed assessments, educators should routinely use protocols such as those outlined in the Science Assessment Task Screening Tools[105] to vet assessments for NGSS alignment. These tools offer a two-tiered approach featuring a quick Prescreen Tool to identify common red flags in assessments, followed by a deeper Screener Tool review process to ensure the assessment is high quality. Both of these tools are built to give PLCs and review teams a common vocabulary for judging three-dimensional quality.

For purchased or district-wide summative tools, apply the Criteria for Procuring and Evaluating High-Quality and Aligned Summative Science Assessments[106] to ensure vendor materials genuinely reflect the phenomenon-centered, three-dimensional standards–not blindly trusting their marketing claims. This document provides you with a criterion-based process for vetting vendor interim/benchmark assessment.

School site and district teams should routinely check for vertical coherence between formative and summative measures, ensuring the sense-making students practice throughout a unit matches what summative assessments require. Teams should also build explicit equity checks into every assessment design and review cycle, confirming that English Learners and students with disabilities can access phenomena and demonstrate three-dimensional practices through multiple modes.

CAST Interim Assessments (IAs)

The **CAST Interim Assessments (IAs)** are available through **CAASPP's Test Operation Management System (TOMS)**. The California Science Test (CAST) Interim Assessments (IAs) were released in two rounds, with the first round released during the 2023–24 school year and the second round of updates released during the 2024–25 school year.

The following Science IAs are available:

- Two (2) IAs for 3rd Grade, 4th Grade, and 5th Grade — all of which contain all three domains (physical, life, and earth sciences);

[104] https://www.nextgenscience.org/task-annotation-project-science
[105] https://www.nextgenscience.org/task-screening-tools/science-assessment-task-screening-tools
[106] https://www.nextgenscience.org/resources/criteria-procuring-and-evaluating-high-quality-and-aligned-summative-science-assessments

- Six (6) IAs for middle school and high school — two for physical sciences, two for life sciences, and two for earth and space sciences.

The grade five assessment draws on PEs from grades three through five (3–5) and includes the foundational concepts that are addressed in kindergarten through grade two (K–2). The grade eight assessment draws on PEs from grades six through eight (6–8) which are coded with MS, such as MS-ESS2-1. The high school assessment draws on PEs from the grades nine through twelve (9–12) which are coded with HS, such as HS-PS3-2.

Each IA has one performance task, which needs to be hand-scored through the Teacher Hand Scoring System (THSS). Once scored, after about 20 min, the data will be posted on California Educator Reporting System (CERS). More examples of PTELs are available through Authentic Tasks for Learning and Assessment in Science (ATLAS).[107]

Administrators can support by:

- Monitoring the quality and frequency of assessment.
- Reviewing student work alongside teachers to identify trends.
- Providing time and structures for data-informed instructional planning.

The CAST Item Specifications[108] describe how items for the CAST are developed to assess the California Next Generation Science Standards (CA NGSS). With these specifications, educators will gain a better understanding of the three-dimensional nature of the CAST; however, they are not intended to guide instruction.



Related Resources:

ATLAS[109] is a free digital platform for all science educators in California. Created with teachers, for teachers. ATLAS provides a rich, growing library of NGSS-aligned performance tasks for grades K-12. Our goal is to empower educators by supporting authentic, phenomena-based instruction and assessment that brings science to life.

[107] https://www.ngss-atlas.com/
[108] https://www.cde.ca.gov/ta/tg/ca/castitemspecs.asp
[109] https://www.ngss-atlas.com

An integral part of the instructional cycle is assessment. The California NGSS Toolkit for Student-Centered Assessment[110] is a compilation of tools, processes, and resources designed to support educators at the district and classroom level in designing and implementing curriculum-anchored formative and summative assessment tasks that align to the NGSS and California's system of assessments.

The SAEBL Checklist[111] (Science Assessment for Emergent Bilingual Learners) is a tool designed to help educators and curriculum writers create equitable, three-dimensional science tasks for students who are learning English. It ensures that science assessments allow students to show what they know without language barriers hiding their true understanding.

The A Framework to Evaluate Cognitive Complexity in Science Assessments[112] can be used to assess the degree to which an assessment task asks students to intellectually engage in and make use of disciplinary core ideas, science and engineering practices, and cross-cutting concepts in service of sense-making.

Key Takeaway: Align Formative and Summative Assessments to the NGSS

Assessment systems should mirror the thinking CAST measures—integrating performance tasks and real-time checks for understanding. A balanced system of classroom, benchmark, and state assessments supports instructional improvement.

Use Data to Drive Continuous Improvement in Instruction

Instructional shifts should be grounded in what the data reveal. Using data to drive continuous improvement in science instruction transforms student work, such as formative quizzes, inquiry lab rubrics, and entry tickets, into actionable insights for daily teaching. By routinely analyzing performance patterns, educators identify misconceptions in core concepts and refine instructional strategies to support the development of skills and practices. Iterative feedback loops ensure science pedagogy continuously adapts to foster deeper conceptual understanding, critical reasoning, and mastery of scientific practices.

[110] https://www.sdcoe.net/ngss/toolkit

[111] https://www.nsta.org/sites/default/files/journal-articles/Figure%201_Science%20Assessment%20for%20Emergent%20Bilingual%20Learners%20(SAEBL)%20Checklist.pdf

[112] https://www.nextgenscience.org/sites/default/files/Science%20Cognitive%20Complexity%20Framework_Final_093019.pdf

You can help teacher teams use various grain-sizes of student achievement data, from CAST down to local data, to:

- Identify areas of student strength and areas where students may currently need more support.
- Uncover barriers in the environment or curriculum.
- Plan responsive instruction that fosters a supportive, inclusive environment that meets the needs of all learners.

For example, if a CAST domain data shows consistent underperformance in Physical Science, teams might:

- Re-examine curriculum pacing and lab access.
- Identify gaps in instructional strategies or student engagement.
- Review notebook artifacts or student interviews to identify misunderstandings.

Use classroom observations and collaborative PLCs to validate patterns and monitor changes over time. Data use is most powerful when it becomes part of an ongoing cycle of inquiry and improvement. Continue to revisit the data, listen to student experiences, and adjust instruction and supports based on what you learn.

Related Resources:

See **Section 2.3: Grain-Size of Science Data and Their Significance** for more information on various types of student achievement data, and **Section 2.5: Tools for Analyzing and Interpreting Science Data** for several tools (e.g., Data Inquiry Cycle, Root Cause Analysis, Data Analysis Templates) that support the data analysis and application process.

Key Takeaway: Use Data to Drive Continuous Improvement in Instruction
CAST and local data should guide instructional decisions. Root cause tools help teams identify what's really driving student performance and focus on equity-centered action.

Create Instructionally-Focused Classroom Observation Systems

Use classroom observation as a tool for action, not compliance. The purpose of an observation should determine what is noticed, documented, discussed and, most importantly, what happens next. Formal evaluative observations are conducted by

administrators as part of the educator evaluation process and focus on evidence of instructional practice in relation to established expectations or standards. Non-evaluative learning-focused observations, such as peer observations, learning walks, or instructional rounds, are opportunities for educators to step into classrooms to study student learning, engagement, and sensemaking. When educators can examine instruction together without the observation being tied to evaluation, they can build shared understanding of effective science instruction, identify promising practices, and determine where additional support is needed.

Build an observation system that turns evidence into action. Classroom observations should be more than compliance checks. When designed well, they:

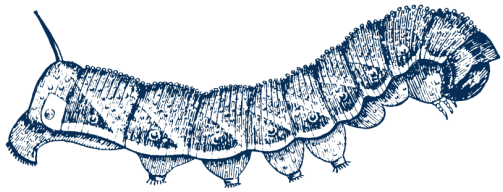
- Provide real-time feedback to teachers.
- Help leaders calibrate their understanding of NGSS instruction.
- Identify bright spots and effective practices that can be shared and strengthened across classrooms.
- Examine the student experience by looking for evidence of how students are engaging in science, making sense of phenomena, using evidence, and communicating their thinking.
- Identify patterns across classrooms that may point to system-level strengths, barriers, or opportunities for improvement.
- Determine professional learning and coaching needs based on observed evidence rather than assumptions.
- Monitor the impact of instructional changes by returning to classrooms and examining whether changes are improving opportunities for students to engage in three-dimensional science learning.

Learning-focused classroom observations can look for evidence of:

- Evidence of three-dimensional learning: Students engage in science and engineering practices, use disciplinary core ideas, and make connections through crosscutting concepts.[113]
- Student sensemaking: Students have opportunities to develop, revise, and communicate their own explanations of phenomena or solutions to problems.
- Student discourse and thinking: Students talk, listen, question, argue from evidence, and use notebooks or other representations to make their thinking visible.

[113] https://www.nextgenscience.org/three-dimensional-learning

- Meaningful engagement: Students are intellectually engaged in relevant phenomena, problems, investigations, and real-world applications of science.
- Access and inclusion: Instruction provides meaningful opportunities for all students to participate, contribute their ideas, and demonstrate their learning.
- Implementation of high-quality instructional materials: Teachers are supported to use adopted materials as designed while making thoughtful adaptations based on student needs.



Turn your observations into a continuous improvement cycle. After observing, ask:

- What did we notice?
- What does this tell us about students' opportunities to learn science?
- What patterns are emerging?
- What support or action is needed?
- How will we know whether our response made a difference?

Use these conversations to connect classroom evidence to coaching, professional learning, curriculum implementation, and broader system improvement.

See Section 3: Strengthening Science Within Your System, Recommendation 2 for more information on system audits and use of the "Mind the Gap" framework to analyze adult practice.

Related Resources:

The California Partnership for Math and Science Education developed a series of five Principals Supporting the CA NGSS[114] modules designed to support site leaders with the implementation of the California Next Generation Science Standards (CA NGSS). The

[114] https://psngss.acoe.org/

modules include supporting documents, such as the CA NGSS Classroom Observation Tool.[115]

Instructional Leadership for Science Practices (ILSP),[116] provides tools for the effective integration of science practices into classrooms in order to support a wide range of students, including those typically underrepresented in science, to develop greater scientific literacy. The ILSP tools are intended to support educational leaders and teachers in evaluating and improving classroom instruction of science practices. The tools are organized in two sections: Tools for Supervision,[117] and Tools for Instruction.[118]

Although the OEI Observation Tool[119] was designed to review school level implementation of the OpenSciEd instructional model, the tool can easily be used with any adopted science materials. The walkthrough tool is aligned to NGSS shifts and equity-focused look-fors. The goal of the OpenSciEd Equitable Science Instruction (OEI) Initiative at Boston College is to help disrupt these inequalities by supporting schools and teachers in instruction that begins with the interests and curiosities of students and empowers student voices to support more equitable learning opportunities for all students.

Supporting teachers with implementation on the classroom-level as well as managing the school-level use of high-quality instructional materials is essential. Sustainable curriculum implementation requires active partnership. The Instructional Leadership[120] section of the NGSS Curriculum Tools developed by Boston College have been designed to build capacity in all leaders with thoughtful guidance and actionable strategies.

The California NGSS Early Implementers developed Next Generation Science Standards in Practice[121], including classroom walkthrough tools specifically to help educators examine what NGSS implementation looks like in practice. *Empowering Administrator Support of NGSS Implementation* can be found on pages 31 - 37 and *CA NGSS Early Implementers Initiative Science Walk-Through Tool* can be found as Appendix J. on pages 64-65.

[115] https://drive.google.com/file/d/1w244Y02h-2VEOSjw2aZc0TxjbDh9mRr1/view
[116] https://www.sciencepracticesleadership.com/
[117] https://www.sciencepracticesleadership.com/supervision-tools.html
[118] https://www.sciencepracticesleadership.com/instruction-tools.html
[119] https://docs.google.com/document/d/1aOASN1HnUiNh56zfN-UYe4zAVCQbjieRIKmAqzvQ9os/edit
[120] https://www.ngsscurriculumtools.com/instructional-leadership
[121] https://files.eric.ed.gov/fulltext/ED596757.pdf

Key Takeaway: Create Instructionally-Focused Classroom Observation Systems

Classroom observations can be powerful when they go beyond compliance to support teacher growth. Look for 3D learning, student discourse, and curriculum use. Evidence from walkthroughs should be used to inform professional learning and classroom instruction.

4.4 Spotlight Examples

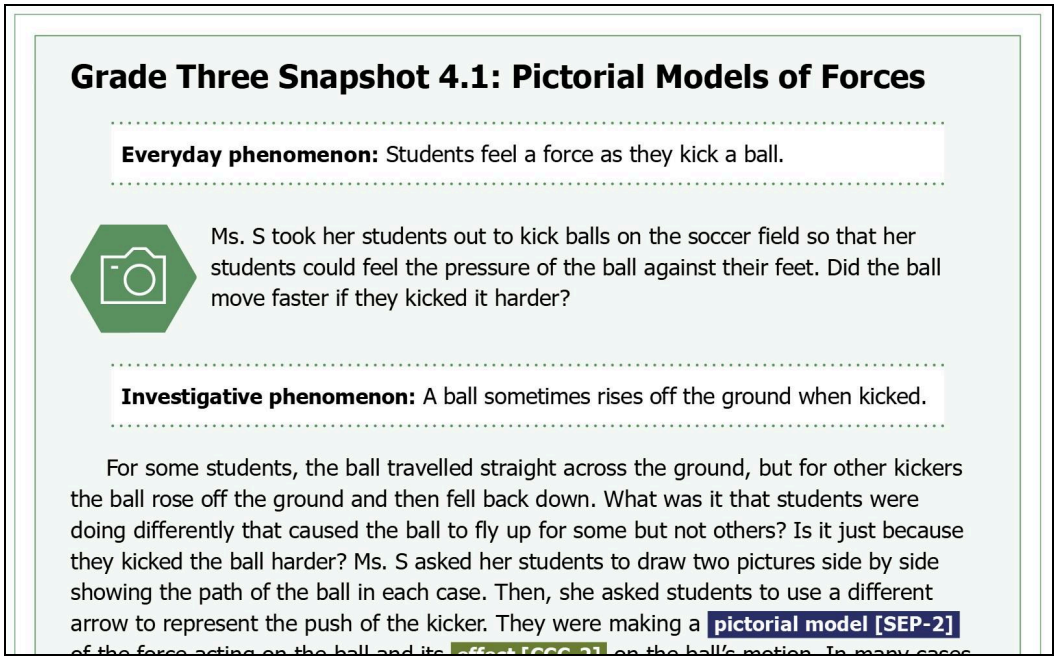
Implementation of high-quality science instruction is happening across the state. The efforts of elementary and middle school teachers from Paso Robles Joint Unified School and Santa Maria-Bonita School Districts are highlighted in these Teacher Stories from Ambitious Science Teaching.[122] Early success with the CA NGSS K-8 Early Implementation Initiative are highlighted in Getting Good at Getting Better.[123] This article highlights the power of walk throughs using a walkthrough tool that features three rubrics to address the major shifts required by NGSS: phenomena-based instruction, three dimensional sense-making, and student-to-student discourse.

High-Quality Science Instruction can result in CAST success stories, like this one from Wolf Canyon Elementary School in the Chula Vista Elementary School District. *The Power of High-Quality Science Instruction*[124] by Chelsea Cochrane highlights the success that occurs when teachers focus on meeting the needs of all learners.

The CA Science Framework includes additional snapshots[125] (*Figure 4.1* below) and vignettes[126] (*Figure 4.2* below) that provide examples of what NGSS-aligned instruction looks like and sounds like in California K-12 classrooms.

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[122] https://ambitiousscienceteaching.org/teacher-stories-modeling-and-eliciting-student-ideas/
[123] https://classroomscience.org/articles/ngss/ngss-early-implementers/getting-good-getting-better
[124] https://classroomscience.org/articles/fyi/power-high-quality-science-instruction
[125] *Science Framework for California Public Schools: Kindergarten Through Grade Twelve* (2016) https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter4.pdf#page=116
[126] *Science Framework* (2016) https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter7.pdf#page=212



Grade Three Snapshot 4.1: Pictorial Models of Forces

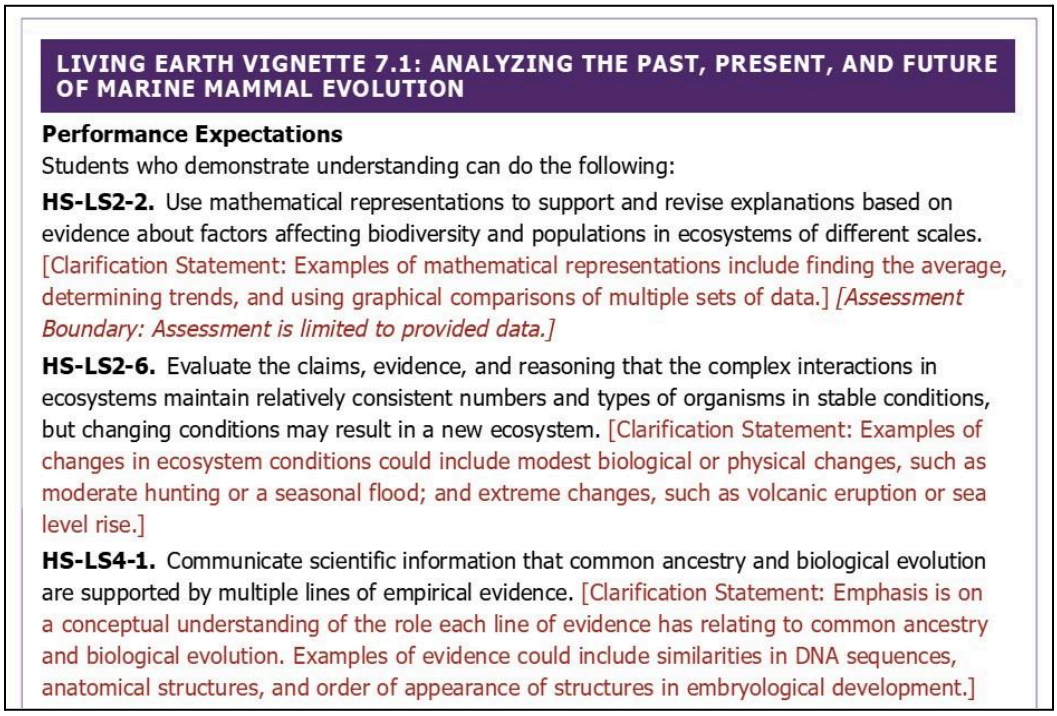
Everyday phenomenon: Students feel a force as they kick a ball.

Ms. S took her students out to kick balls on the soccer field so that her students could feel the pressure of the ball against their feet. Did the ball move faster if they kicked it harder?

Investigative phenomenon: A ball sometimes rises off the ground when kicked.

For some students, the ball travelled straight across the ground, but for other kickers the ball rose off the ground and then fell back down. What was it that students were doing differently that caused the ball to fly up for some but not others? Is it just because they kicked the ball harder? Ms. S asked her students to draw two pictures side by side showing the path of the ball in each case. Then, she asked students to use a different arrow to represent the push of the kicker. They were making a **pictorial model [SEP-2]**

Figure 4.1: Example Snapshot, *Science Framework…* (2016, CA SBE)



LIVING EARTH VIGNETTE 7.1: ANALYZING THE PAST, PRESENT, AND FUTURE OF MARINE MAMMAL EVOLUTION

Performance Expectations

Students who demonstrate understanding can do the following:

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] *[Assessment Boundary: Assessment is limited to provided data.]*

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

Figure 4.2: Example Vignette, *Science Framework…*(2016, CA SBE)

4.5 Reflection and Call to Action

Planning and supporting student-centered science instruction and assessment is essential for translating California's Next Generation Science Standards (CA NGSS) vision into everyday classroom reality. The guidance in this section emphasizes shifting classroom dynamics toward active, three-dimensional sense-making, ensuring consistent TK–12 access, and establishing balanced assessment and observation routines that foster continuous, equity-focused improvement.

As you consider next steps for your district or school, use the following actions and questions to guide your work.

Supporting Teachers and Building Instructional Capacity

Ensure educators across all roles have access to collaborative planning structures, differentiated professional learning, and leadership support to deepen three-dimensional science teaching.

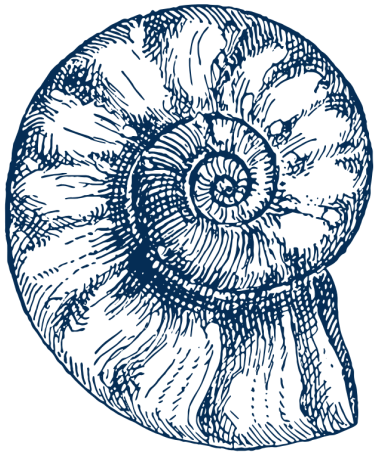
Questions to consider:

- What support structures, protected collaborative planning time, and peer observation opportunities currently exist for our teachers to plan, examine student thinking, and reflect on NGSS-aligned instruction?
- What high-quality, ongoing professional learning is available to build content and pedagogical capacity across grade levels, and how are our support systems differentiated for new versus experienced teachers, coaches, and administrators?
- What opportunities do teachers have to observe, discuss, and learn from one another's science instruction?
- How are our teacher leaders, coaches, and administrators developing their own understanding of high-quality NGSS instruction?

Observing and Supporting Science Instruction

Establish growth-focused, non-evaluative observation routines that surface evidence of student sense-making and inform ongoing professional support.

Questions to consider:



- What patterns emerge during our classroom observations, and what evidence shows that students are actively engaging with real-world phenomena, and using the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts?
- How are we using classroom observations and feedback loops used to distinguish non-evaluative study of student learning from formal evaluation, while identifying instructional strengths and professional learning needs?
- What feedback loops do we have in place to ensure that evidence from classroom observations leads to meaningful support and follow-up?
- How are our administrators distinguishing between evaluative observations and non-evaluative opportunities to study student learning?

Using Assessment to Improve Instruction

Design and utilize balanced assessment practices that evaluate three-dimensional application and guide responsive teaching in real time.

Questions to consider:

- How consistently do we provide students with opportunities to apply three-dimensional learning to new phenomena and how are we using formative assessment and student work to identify and respond to student thinking?
- What opportunities exist for teachers to collaboratively examine assessment results, and how are those insights used to inform our adjustments in curriculum, instruction, professional learning, and resource allocation?

Making Meaning of CAST Data

Use summative assessment results in combination with local classroom evidence to investigate system patterns and refine instructional priorities.

Questions to consider:

- How are CAST and benchmark data examined across grade levels, science domains, student groups, and schools to reveal patterns of strength or need regarding three-dimensional learning opportunities?
- What additional evidence (e.g., student work, observations, student voice) are we analyzing alongside CAST data to frame results as an inquiry into instruction rather than an evaluation of individuals? How are we evaluating the impact of actions taken?
- How are CAST results being used to generate questions about instruction rather than simply identify students or teachers who need improvement?

Ensuring Access to High-Quality Science

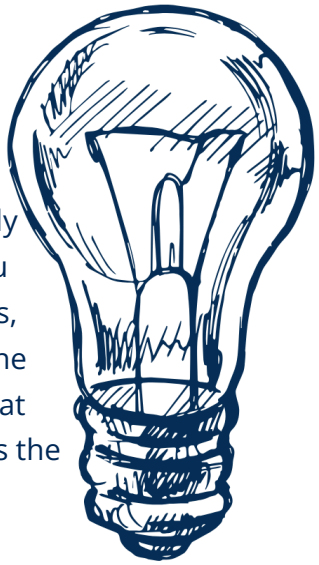
Guarantee that every student from transitional kindergarten through high school receives protected, coherent, and rigorous science learning experiences.

Questions to consider:

- Are all students across grades, schools, and student groups provided consistent access to protected, high-quality, NGSS-aligned science instruction? Are there particular grades, student groups, or schools where access to science learning is limited?
- How does science learning build coherently from grade to grade to provide repeated, increasingly complex opportunities with the standards, and how are instructional materials supporting or limiting this progression?

Your ultimate goal in transforming science instruction and assessment is to cultivate vibrant, equitable learning environments where every California student has meaningful opportunities to actively make sense of the world. By aligning professional capacity, observation practices, assessment tools, data inquiry, and system-level supports, you can build the conditions for continuous improvement and sustained student success.

As an educational leader, you are essential to making this vision a reality.



You influence the time, resources, professional learning, curriculum, collaboration, and instructional support that shape students' experiences in science. Use data and classroom evidence to identify and address inequities in access and opportunity, elevate student strengths and voices, and ensure that every student, including students who have been historically underserved, has access to culturally responsive science learning. When you create the conditions for educators to learn, collaborate, take informed risks, and continuously improve, you move beyond identifying gaps to changing the systems and practices that create them. Your leadership can help ensure that equity is not an outcome we hope to achieve, but a commitment that guides the decisions you make every day.