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a New Era in High School Science Education

A Guide to NGSS and Supporting the
Transition to Phenomena-Based,
Three-Dimensional Learning

 **Kognity**

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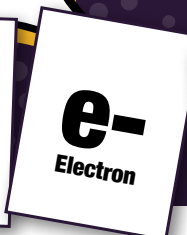
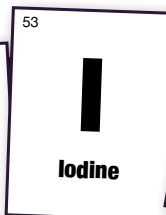


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Navigating NGSS Implementation: Challenges & Solutions

The Next Generation Science Standards (NGSS) represent a transformative shift in science education, emphasizing not just the acquisition of knowledge but the development of critical thinking and problem-solving skills. At its core, NGSS aims to prepare students for a world where scientific literacy is essential for informed citizenship, college readiness, and career success. High school teachers charged with preparing students for this rapidly and continuously changing world face a unique set of challenges, as well as opportunities. This guide is designed to support educators in navigating the complexities of NGSS, providing practical strategies and resources to enhance teaching and learning.

Despite its promise, the implementation of NGSS can be daunting. One of the most significant hurdles teachers face is transitioning from traditional content-focused instruction to a three-dimensional learning model, including three-dimensional assessment methods. Fortunately, over the past decade, educational institutions, research centers, and science educators have been conducting research and providing insights into the effectiveness of NGSS, identifying challenges in implementation, and offering recommendations for best practices to support educators in this journey.

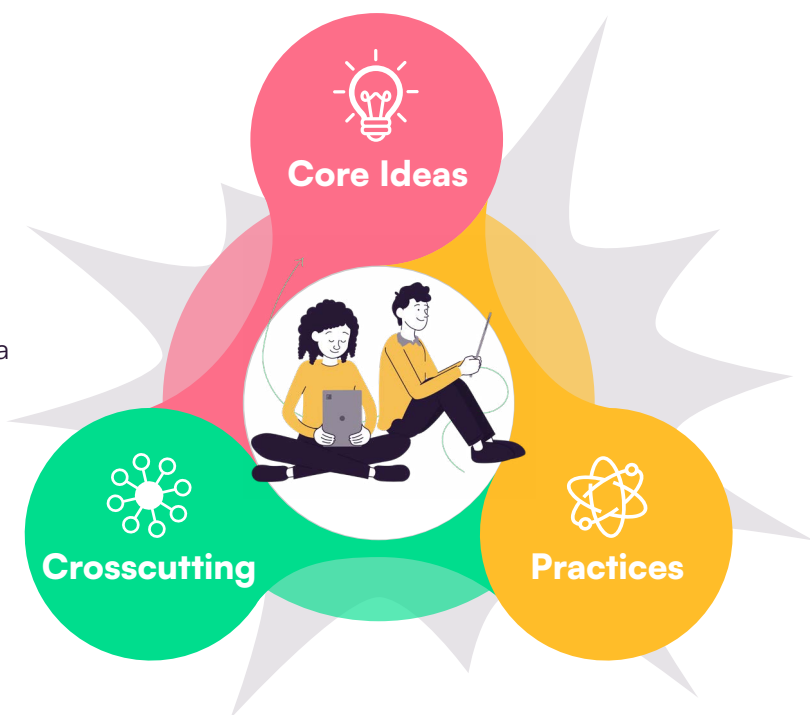
This guide will distill these learnings by exploring the NGSS philosophy and its implications for high school education. You'll also find instructional strategies to engage students in phenomena-based learning, tips for starting three-dimensional assessment, and resources to support educators. Our goal is to empower you and your teachers with the knowledge and confidence to create dynamic, inquiry-based science classrooms where all students can thrive.

Use this guide as a roadmap to empower yourself and your teachers with the knowledge and confidence to create dynamic, three-dimensional science classrooms where all students can thrive.



Foundations of NGSS: The Philosophy Behind the Standards

The NGSS is rooted in the belief that science education should be accessible, engaging, and relevant to all students. It seeks to shift the focus from rote memorization of facts to a deeper understanding of scientific concepts and the processes of scientific inquiry. This approach is encapsulated in three dimensions: **Disciplinary Core Ideas (DCIs)**, **Science and Engineering Practices (SEPs)**, and **Crosscutting Concepts (CCCs)**.

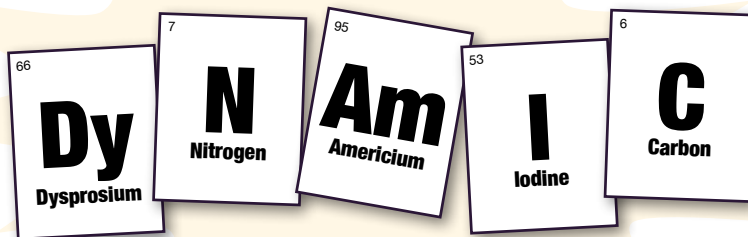


Disciplinary Core Ideas (DCIs) form the foundational content that students need to understand.

DCIs represent the “what” of science education, and are grouped into four domains:

- Physical science
- Life science
- Earth and space science
- Engineering, technology, and applications of science

All DCIs are designed to spiral into each grade band, building in complexity as students progress. This structured organization ensures that students develop a coherent understanding of science over time, rather than learning isolated facts.

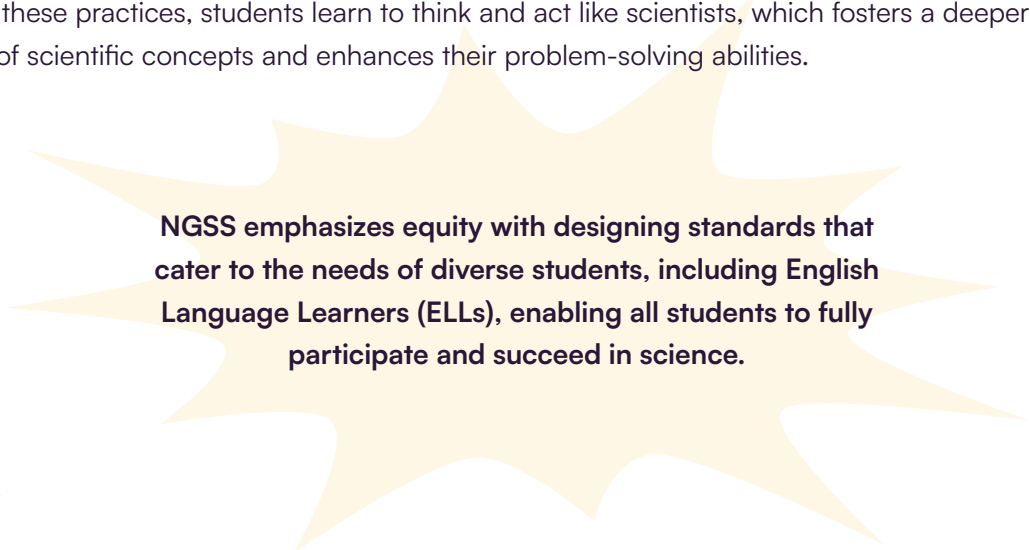




Science and Engineering Practices (SEPs) focus on the skills and behaviors that scientists and engineers use in their work, or the “how” of science. These practices include:

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

By engaging in these practices, students learn to think and act like scientists, which fosters a deeper understanding of scientific concepts and enhances their problem-solving abilities.



NGSS emphasizes equity with designing standards that cater to the needs of diverse students, including English Language Learners (ELLs), enabling all students to fully participate and succeed in science.



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Crosscutting Concepts (CCCs) are the themes that bridge disciplinary boundaries, helping students to see the connections between different areas of science. These concepts help students uncover connections between the four disciplines in science, and create a common vocabulary for students:

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

CCCs, or the “glue” between scientific disciplines, are woven throughout the NGSS framework. By recognizing these themes, students can apply their knowledge more broadly and develop a more integrated understanding of science.

The NGSS philosophy also emphasizes equity and inclusion in science education. It aims to provide all students, regardless of their backgrounds or abilities, with the opportunity to engage meaningfully with science. This is achieved by presenting science in a context that is real and relevant to students’ lives and by using instructional strategies that are responsive to diverse learners.

Streamline NGSS Implementation With Ease

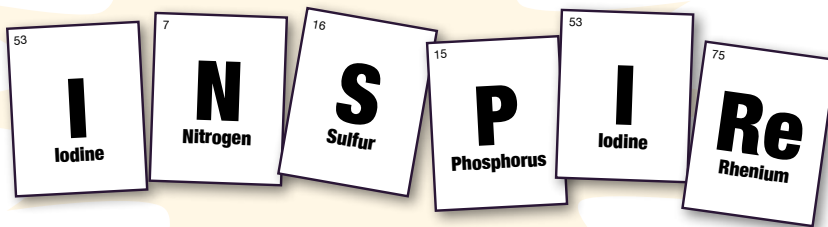
Expertly crafted for NGSS, Kognity’s science content empowers teachers to implement complex standards with ease. The curriculum seamlessly integrates performance expectations (PEs), crosscutting concepts (CCCs), science and engineering practices (SEPs), and disciplinary core ideas (DCIs). With easy access to activities, lesson plans, and assessments, teachers can focus on enhancing student performance while efficiently tracking progress in three-dimensional learning.



Kognity helps students make connections.”

— Belvedere, IL: Special Ed Teacher

Instructional Strategies to Engage Students in Phenomena-Based Learning



Truly engaging students in science is at the heart of NGSS implementation, and phenomena-based learning is a particularly effective instructional approach to drive students' curiosity, make their learning real and relevant, and deepen their understanding of scientific concepts. When supporting teachers in mastering phenomena-based learning, you are ensuring that all students benefit from this dynamic learning process. Consider the following effective strategies when supporting science teachers:



Phenomena-based Inquiry: Phenomena must be the starting point behind NGSS lessons.

These real-world occurrences ignite curiosity and motivate students to seek explanations, making their learning both relevant and enduring. To fully engage students, phenomena should be used throughout learning, from launching a unit or lesson to evaluating student understanding.

Encourage teachers to present phenomena that are both familiar and challenging to students, such as the changing seasons or the physics of roller coasters. The key to deepening understanding lies in empowering students to ask their own questions about the phenomena and guiding them to explore these questions through structured, student-driven investigations.

TIP:

Encourage teachers to select phenomena that resonate with students' lives and communities, making learning even more relevant and meaningful. Additionally, look for opportunities where students are not just observing phenomena but are actively questioning and seeking answers through hands-on, minds-on investigations.



Kognity's high school science curriculum provides a range of phenomena in every unit to help teachers spark this investigative spirit!



Hands-on, Minds-on Investigations: Once students' curiosity is piqued, they must be the ones to actually investigate phenomena. While hands-on activities are generally enjoyable to students, it's essential to move beyond that to "hands-on, minds-on" investigations.

Investigations must actively involve students in scientific practices (aka the SEPs in the NGSS) to build understanding. This involves encouraging critical thinking and making connections, whether through hands-on experiments, creating models and/or using simulations. For example, instead of merely building a model of the solar system, students might create a model or use a simulation that helps them understand and explain how gravitational forces affect planetary orbits.

TIP:

Look for lessons where students are not just participating in an activity, but are also asked to document their observations, reflect on what they've learned, and apply their understanding to new contexts. A great starting point could be wrap-up discussions, where students are asked to share their learning from the investigation and apply it in a new context.





Collaborative Learning: Collaboration is integral to fostering a dynamic, three-dimensional learning environment where students can explore and make sense of complex scientific phenomena together. In NGSS-aligned classrooms, students should be encouraged to work in groups so they can share ideas, debate concepts, and build on each other's knowledge. Structured group work, where each student has a defined role—whether it's leading a discussion, recording observations, or presenting findings—ensures active participation and mirrors the collaborative nature of scientific inquiry. This approach not only promotes accountability but also helps students develop essential communication and teamwork skills.

TIP:

Look for and emphasize the importance of clear roles within group activities. Encourage the use of collaborative digital tools to support group work, especially in diverse classrooms. Teachers should also create opportunities for students to reflect on how collaboration enhanced their understanding and to apply their collective insights to new challenges.



Engage Students with Phenomena-Based Learning and Dynamic Media Resources

Kognity lessons are centered around natural phenomena, using a curated Driving Question Board to foster student-led, teacher-guided learning. This approach connects classroom concepts to real-life situations, boosting student engagement. Kognity's Media Library offers over 220 videos, 740 images, 650 interactives, and a reading tool supporting 130+ languages.



Connecting Crosscutting Concepts with Real-World Applications: Crosscutting concepts (CCCs) are essential frameworks that help students make sense of complex scientific phenomena by providing and building upon mental schema to organize and understand new information. To maximize the impact of CCCs, it's crucial to connect them with real-world applications that resonate with students' lives and experiences.

By using CCCs as a lens through which students can view and solve real-world problems, you foster a deeper, more rigorous understanding of science, ensuring that all students, regardless of background, are engaged in challenging and equitable learning experiences. Encourage teachers to consistently incorporate CCCs into lessons across grade levels, gradually increasing the complexity and sophistication of these concepts as students advance.

TIP:

CCCs are often seen as the most “vague” strand of three-dimensional learning, even though teachers may already be incorporating them into their lessons without realizing it. Support teachers by reviewing CCCs together and planning lessons where CCCs are integrated with the other two strands of learning, rather than taught in isolation. Encourage the use of real-world examples that students can relate to, making science a continuous learning process of connecting concepts to their everyday lives. Look for lessons that revisit and reinforce CCCs throughout learning sequences.



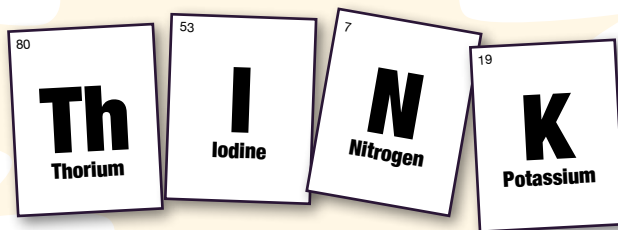
Three-dimensional Assessment Tasks: Just as NGSS instruction is built around three-dimensional learning, assessments must also evolve to align with these standards. Traditional assessments fall short of capturing the depth and complexity of student understanding in a three-dimensional classroom. Assessments should require students to apply their knowledge across the three dimensions discussed earlier in this guide: DCIs, SEPs, and CCCs.

For example, instead of simply recalling facts, students might be asked to analyze a real-world phenomenon, develop a model to explain it, and use evidence-based reasoning to justify their explanation. While this shift may be challenging, it is essential for ensuring that assessments truly reflect and reinforce the goals of three-dimensional learning.

TIP:

Emphasize the importance of creating assessment tasks that are rooted in real-world phenomena and that require students to engage with all three dimensions of learning. Encourage teachers to start small by integrating performance tasks into their existing assessments and gradually expanding to more complex, multi-dimensional tasks. Remind them that the goal is not just to test what students know but to understand how they can apply their knowledge in new and meaningful ways.

Three-Dimensional Assessment & Evaluation in Action



As science instruction changes and becomes three-dimensional, assessments must also adapt to meet the demands of three-dimensional standards and learning. Effective science assessments are crucial for educators to evaluate students' knowledge development and for students to understand how their knowledge can be applied in various situations. To ensure that students are gaining lasting scientific understanding and honing their sensemaking abilities, assessments need to go beyond rote memorization and challenge students to apply their learning in innovative and unfamiliar contexts.

Three-dimensional assessments represent a major shift in thinking about assessments and may take a while to get used to. Here are a few tips to get you started:

- 1. Integrate Phenomena and Real-World Data:** Anchor assessments in real-world phenomena to make them relevant and engaging. Use data that students can connect with, enhancing the authenticity of the tasks. (We hope that, if nothing else, you walk away after reading this guide with the understanding that all parts of today's science education must be phenomena-based, real, and relevant!)
- 2. Use Transfer Tasks:** Implement performance tasks that require students to apply their knowledge in practical and meaningful ways. These tasks should challenge students to solve problems, design solutions, and demonstrate understanding through some type of action.
- 3. Develop Rubrics for SEPs and CCCs:** Create rubrics that assess students' proficiency in SEPs, and their understanding of CCCs, alongside the DCIs. Use the Evidence Statements for each NGSS performance expectation to support developing these rubrics.
- 4. Use Frequent Informal Assessments to Inform Instruction:** Use low-stakes formative assessments regularly to track progress and adjust instruction. These can be quick checks for understanding, exit tickets, or small tasks like annotated drawings or model analysis that provide insight into students' grasp of the material. These low-stakes assessments can also reduce the pressure of high-stakes testing for students.
- 5. Provide Frequent Feedback and Encourage Reflection:** Offer timely feedback and facilitate reflective activities to help students assess their learning processes and outcomes. Encourage students to use insights from their assessments to improve future performance.

Creating three-dimensional assessments may feel daunting, but there are many resources to support educators and instructional leaders in this transition. NGSS provides tools like the [Science Task Prescreen](#) and [Science Task Screener](#) to inform reviews of current assessment tasks. Kognity also simplifies this transition with ready-to-use performance tasks, making it easier for teachers to implement effective and engaging three-dimensional assessments without extensive preparation.



Kognity provides teachers with a wide range of integrated student assessment activities that cater to all learners. Easy-to-read reports offer insights into students' 3-dimensional skills that can guide Tier 1 instruction as well as individualized supports.

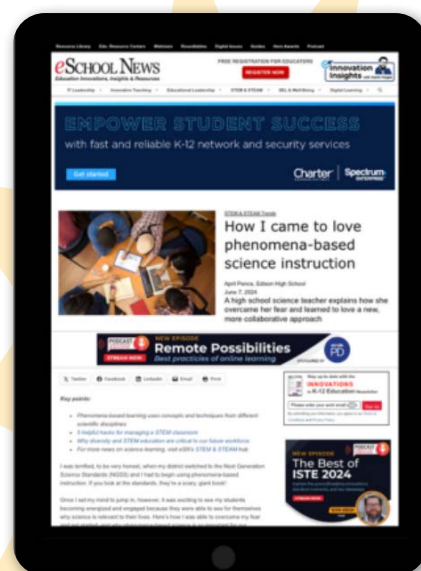


NGSS Success in the Field: April's Journey With Phenomena-based Instruction

"I was terrified, to be very honest, when my district switched to the Next Generation Science Standards (NGSS) and I had to begin using phenomena-based instruction."

That was April Pence's first reaction to the shift to phenomena-based instruction. Like many educators, April, a high school science teacher at Edison High School (CA), was not used to this way of teaching. But, her initial reservations about the complexity of NGSS were soon overshadowed by the visible positive impacts on her students' engagement and comprehension.

April very quickly shifted classroom dynamics to focus on student-driven inquiries and utilizing real-life phenomena to anchor lessons. This not only increased student engagement but also improved students' ability to connect scientific theories to real-world applications. April's transition was aided by **Kognity High School Science**. Kognity's curriculum includes embedded Performance Expectations, Crosscutting Concepts, Science and Engineering Practices, and Disciplinary Core Ideas and lessons are centered around a rooted phenomenon. A Driving Questions Board encourages a student-led and teacher-guided approach in the classroom while three-dimensional assessments ensure students are building their scientific knowledge.



"It's made teaching exciting for me again. It has energized me and refreshed my excitement to teach new things. When my students feel connected to the information they're learning, it makes me feel confident that I am not just getting them ready for a test, but preparing them to spend their lives exploring and understanding the world around them."

Read April's full story of embracing phenomena-based instruction [here](#).

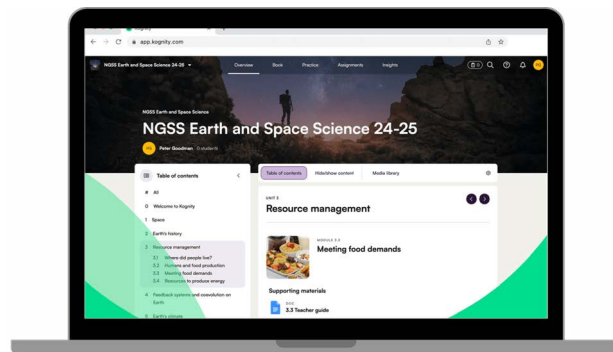
Kognity is Your Partner in NGSS



Empower Teachers, Fuel Student Engagement

Kognity bridges the gap between expert NGSS curriculum and classroom implementation, making science accessible and engaging for every student.

Our NGSS-aligned curriculum is designed for seamless adoption, ensuring consistent instruction across your school. Kognity provides personalized teaching options and a variety of interactive content to reach all learners, whether in-class, online, or at home. Implementing NGSS has never been easier.



See the magic for yourself! Explore Kognity's High School Science Curriculum when you [sign up for our 30-day free trial](#).

[Explore Now](#)



[Kognity teaches] NGSS unlike anything we've seen before or anything that I looked at. But it does it in a way that feels relevant to our kids. They're understanding how life works, how the world around them works and that feels a lot less intimidating to them."

— Webster, KY: Instructional Coach

About the Author:

Rhea May: Educator, Curriculum Developer, and Lifelong Learner

With over a decade of experience in the education sector, Rhea May has been deeply involved in enhancing educational outcomes for students and teachers. As a K-4 science teacher and an assistant principal, Rhea has significantly influenced curriculum alignment and development within a major charter school network. She's also served as the lead curriculum developer for a climate change curriculum aligned with Next Generation Science Standards (NGSS). Passionate about educational equity and the power of science education, Rhea aims to empower educators and students to excel in a constantly evolving educational landscape.



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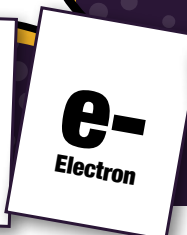
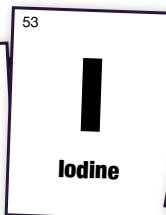


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Navigating CA NGSS Implementation: Challenges & Solutions

California's Next Generation Science Standards (CA NGSS) represent a transformative shift in science education, emphasizing not just the acquisition of knowledge but the development of critical thinking and problem-solving skills. At its core, CA NGSS aims to prepare students for a world where scientific literacy is essential for informed citizenship, college readiness, and career success. High school teachers charged with preparing students for this rapidly and continuously changing world face a unique set of challenges, as well as opportunities. This guide is designed to support educators in navigating the complexities of CA NGSS, providing practical strategies and resources to enhance teaching and learning.

Despite its promise, the implementation of CA NGSS can be daunting. One of the most significant hurdles teachers face is transitioning from traditional content-focused instruction to a three-dimensional learning model, including three-dimensional assessment methods. Fortunately, over the past decade, educational institutions, research centers, and science educators have been conducting research and providing insights into the effectiveness of CA NGSS, identifying challenges in implementation, and offering recommendations for best practices to support educators in this journey.

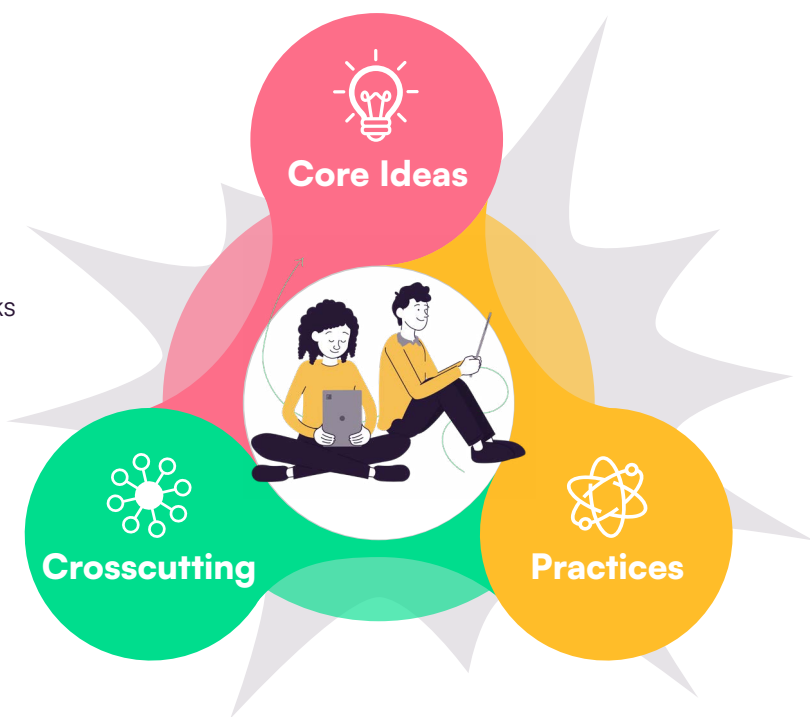
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Foundations of CA NGSS: The Philosophy Behind the Standards

The CA NGSS is rooted in the belief that science education should be accessible, engaging, and relevant to all students. It seeks to shift the focus from rote memorization of facts to a deeper understanding of scientific concepts and the processes of scientific inquiry. This approach is encapsulated in three dimensions: **Disciplinary Core Ideas (DCIs)**, **Science and Engineering Practices (SEPs)**, and **Crosscutting Concepts (CCCs)**.

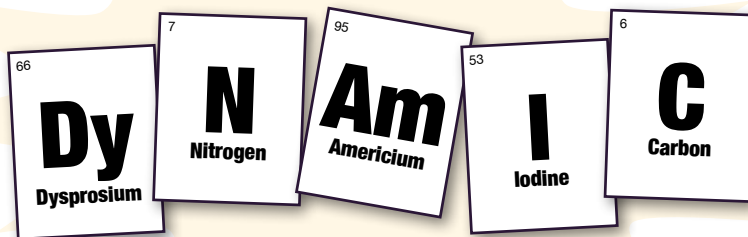


Disciplinary Core Ideas (DCIs) form the foundational content that students need to understand.

DCIs represent the “what” of science education, and are grouped into four domains:

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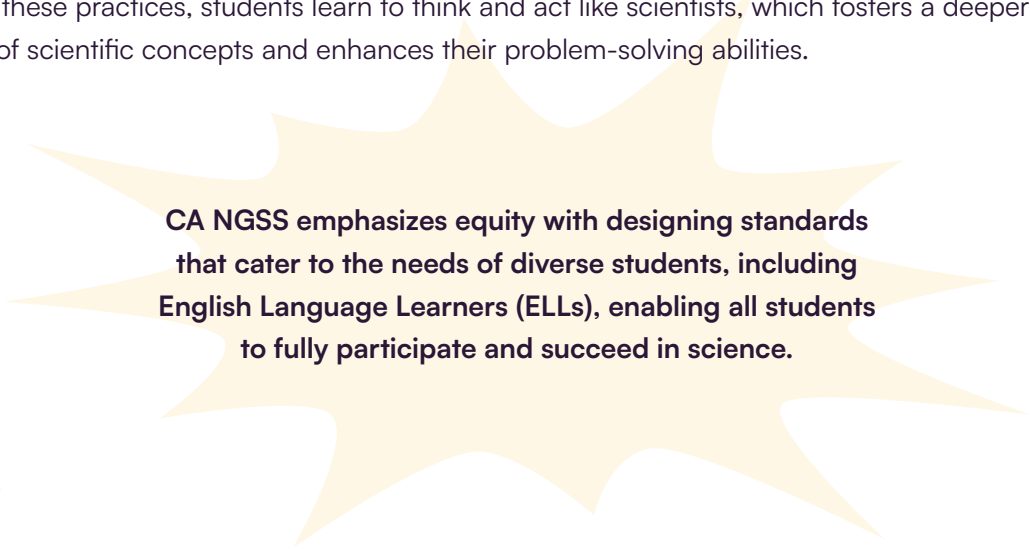




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Streamline CA NGSS Implementation With Ease

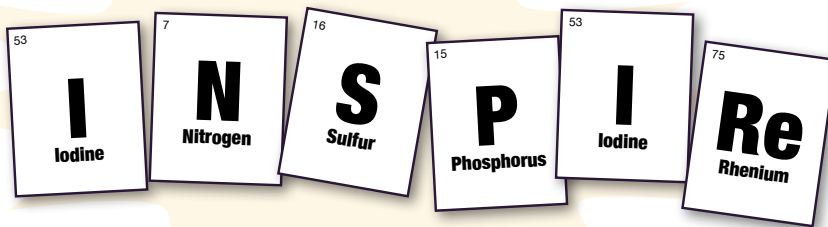
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TIP:

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By using CCCs as a lens through which students can view and solve real-world problems, you foster a deeper, more rigorous understanding of science, ensuring that all students, regardless of background, are engaged in challenging and equitable learning experiences. Encourage teachers to consistently incorporate CCCs into lessons across grade levels, gradually increasing the complexity and sophistication of these concepts as students advance.

TIP:

CCCs are often seen as the most “vague” strand of three-dimensional learning, even though teachers may already be incorporating them into their lessons without realizing it. Support teachers by reviewing CCCs together and planning lessons where CCCs are integrated with the other two strands of learning, rather than taught in isolation. Encourage the use of real-world examples that students can relate to, making science a continuous learning process of connecting concepts to their everyday lives. Look for lessons that revisit and reinforce CCCs throughout learning sequences.



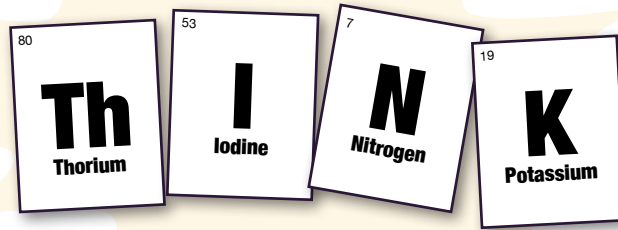
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Emphasize the importance of creating assessment tasks that are rooted in real-world phenomena and that require students to engage with all three dimensions of learning. Encourage teachers to start small by integrating performance tasks into their existing assessments and gradually expanding to more complex, multi-dimensional tasks. Remind them that the goal is not just to test what students know but to understand how they can apply their knowledge in new and meaningful ways.

Three-Dimensional Assessment & Evaluation in Action



As science instruction changes and becomes three-dimensional, assessments must also adapt to meet the demands of three-dimensional standards and learning. Effective science assessments are crucial for educators to evaluate students' knowledge development and for students to understand how their knowledge can be applied in various situations. To ensure that students are gaining lasting scientific understanding and honing their sensemaking abilities, assessments need to go beyond rote memorization and challenge students to apply their learning in innovative and unfamiliar contexts.

Three-dimensional assessments represent a major shift in thinking about assessments and may take a while to get used to. Here are a few tips to get you started:

- 1. Integrate Phenomena and Real-World Data:** Anchor assessments in real-world phenomena to make them relevant and engaging. Use data that students can connect with, enhancing the authenticity of the tasks. (We hope that, if nothing else, you walk away after reading this guide with the understanding that all parts of today's science education must be phenomena-based, real, and relevant!)
- 2. Use Transfer Tasks:** Implement performance tasks that require students to apply their knowledge in practical and meaningful ways. These tasks should challenge students to solve problems, design solutions, and demonstrate understanding through some type of action.
- 3. Develop Rubrics for SEPs and CCCs:** Create rubrics that assess students' proficiency in SEPs, and their understanding of CCCs, alongside the DCIs. Use the Evidence Statements for each CA NGSS performance expectation to support developing these rubrics.
- 4. Use Frequent Informal Assessments to Inform Instruction:** Use low-stakes formative assessments regularly to track progress and adjust instruction. These can be quick checks for understanding, exit tickets, or small tasks like annotated drawings or model analysis that provide insight into students' grasp of the material. These low-stakes assessments can also reduce the pressure of high-stakes testing for students.
- 5. Provide Frequent Feedback and Encourage Reflection:** Offer timely feedback and facilitate reflective activities to help students assess their learning processes and outcomes. Encourage students to use insights from their assessments to improve future performance.

Creating three-dimensional assessments may feel daunting, but there are many resources to support educators and instructional leaders in this transition. CA NGSS provides tools like the [Science Task Prescreen](#) and [Science Task Screener](#) to inform reviews of current assessment tasks. Kognity also simplifies this transition with ready-to-use performance tasks, making it easier for teachers to implement effective and engaging three-dimensional assessments without extensive preparation.



Kognity provides teachers with a wide range of integrated student assessment activities that cater to all learners. Easy-to-read reports offer insights into students' 3-dimensional skills that can guide Tier 1 instruction as well as individualized supports.

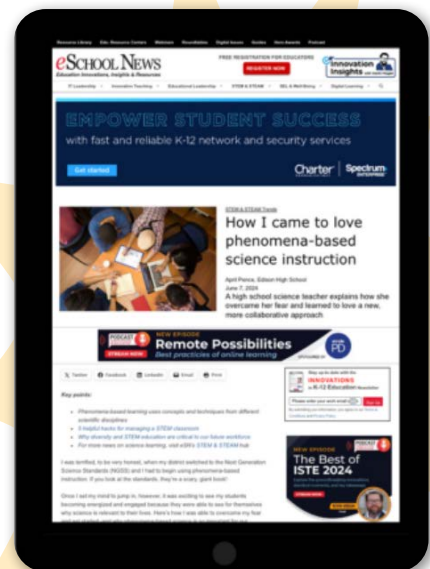


Success in the Field: April's Journey With Phenomena-based Instruction

"I was terrified, to be very honest, when my district switched to the Next Generation Science Standards (NGSS) and I had to begin using phenomena-based instruction."

That was April Pence's first reaction to the shift to phenomena-based instruction. Like many educators, April, a high school science teacher at Edison High School (CA), was not used to this way of teaching. But, her initial reservations about the complexity of NGSS were soon overshadowed by the visible positive impacts on her students' engagement and comprehension.

April very quickly shifted classroom dynamics to focus on student-driven inquiries and utilizing real-life phenomena to anchor lessons. This not only increased student engagement but also improved students' ability to connect scientific theories to real-world applications. April's transition was aided by **Kognity High School Science**. Kognity's curriculum includes embedded Performance Expectations, Crosscutting Concepts, Science and Engineering Practices, and Disciplinary Core Ideas and lessons are centered around a rooted phenomenon. A Driving Questions Board encourages a student-led and teacher-guided approach in the classroom while three-dimensional assessments ensure students are building their scientific knowledge.



"It's made teaching exciting for me again. It has energized me and refreshed my excitement to teach new things. When my students feel connected to the information they're learning, it makes me feel confident that I am not just getting them ready for a test, but preparing them to spend their lives exploring and understanding the world around them."

Read April's full story of embracing phenomena-based instruction [here](#).

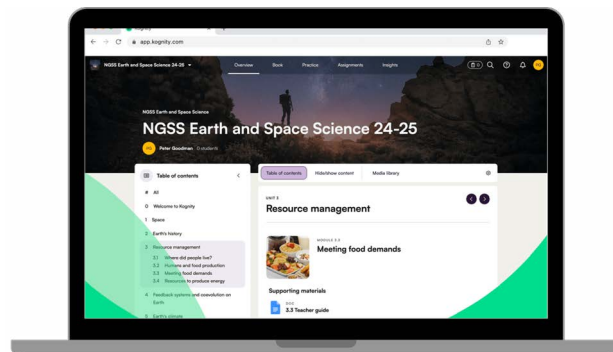
Kognity is Your Partner in CA NGSS



Empower Teachers, Fuel Student Engagement

Kognity bridges the gap between expert CA NGSS curriculum and classroom implementation, making science accessible and engaging for every student.

Our CA NGSS-aligned curriculum is designed for seamless adoption, ensuring consistent instruction across your school. Kognity provides personalized teaching options and a variety of interactive content to reach all learners, whether in-class, online, or at home. Implementing CA NGSS has never been easier.



See the magic for yourself! Explore Kognity's High School Science Curriculum when you [sign up for our 30-day free trial](#).

Explore Now



[Kognity teaches] NGSS unlike anything we've seen before or anything that I looked at. But it does it in a way that feels relevant to our kids. They're understanding how life works, how the world around them works and that feels a lot less intimidating to them."

— Webster, KY: Instructional Coach

About the Author:

Rhea May: Educator, Curriculum Developer, and Lifelong Learner

With over a decade of experience in the education sector, Rhea May has been deeply involved in enhancing educational outcomes for students and teachers. As a K-4 science teacher and an assistant principal, Rhea has significantly influenced curriculum alignment and development within a major charter school network. She's also served as the lead curriculum developer for a climate change curriculum aligned with Next Generation Science Standards (NGSS). Passionate about educational equity and the power of science education, Rhea aims to empower educators and students to excel in a constantly evolving educational landscape.



6 Ways

Districts Can Make STEM Subjects More Accessible to Students from Diverse Backgrounds



Science is a pillar of human thought and decision-making, yet only 20% of high school graduates are adequately prepared for college-level science. Moreover, Latinx and Black students leave STEM majors at significantly higher rates than their white peers.

Here are **six strategies** school leaders can use to support teachers in making STEM subjects more accessible to all students.



1

Host Regular Science Cafes

Science cafes break down traditional barriers to conversation, debate, and interaction between scientists and the public outside a traditional academic context.

By creating on-going teen cafes for your students to engage in, you'll have a greater chance of building a scientifically literate community.



What Is the Origin of Science Cafes?

In the late 1990s, an Englishman named Duncan Dallas started a program for the public called "Café Scientifique: *Science for the price of a coffee.*"

They were so popular that within just a few years, Science Cafes could be found on every continent across the globe.

Offer Community Mentoring & Professional Panels

Invite professionals from your local community, both from traditional and non-traditional STEM careers, into your school to discuss their work and explain how STEM is fundamental to their career.

Highlighting fields where it's not common knowledge how STEM supports what they do can help rebuild the education system in your district by showing real-world applications, inspiring diverse career paths, and fostering an understanding of STEM's role across industries.

Nontraditional STEM Careers

- + Pastry Chefs
- + Medical Illustrator
- + Underwater Archaeologist
- + Gameplay Engineer
- + Pyrotechnic Engineer



3

Strive to Enhance Diversity of Perspectives in STEM Instruction

The future of science education relies on diverse voices to advance society. However, the scientific community is predominantly white, and their cultural ideas, perspectives, and ideologies often shape the outcomes of practices, views, and policies.

By increasing the number of Black, Indigenous, and People of Color (BIPOC) teachers in STEM subjects, students will see themselves reflected in their role models, creating a more welcoming and inclusive school science environment.



4

Offer Targeted Diversity, Equity & Inclusion (DEI) Professional Development to Educators

To create truly inclusive high school science classrooms, schools must equip teachers with the skills to be culturally responsive, ensuring that they can effectively engage with students from all backgrounds.

This training goes beyond basic diversity awareness. It focuses on cultural competence, addressing implicit bias, and integrating diverse perspectives into the curriculum. By fostering these skills, educators can create a classroom environment where every student feels seen and valued, even if their experiences differ from those of their teacher.

The Alliance for Identity-Inclusive

Computing Education: Offers professional learning for educators, researchers, and leaders, encouraging them to examine biases and foster more inclusive academic cultures for non-dominant communities.

The Computer Science Teachers Association's

Equity Fellows Program: Engages K-12 educators in PD on personal biases and identity, with participants leading community projects. A pilot study found participation in the program increased knowledge and confidence in implementing identity-inclusive education.

5

Provide Language Accessibility Tools for Students

With 65% of U.S. schools serving Emergent Bilingual (EB) students, the need for multilingual education is more crucial than ever. As the number of EBs grow, it's essential to provide an education that celebrates diverse identities while ensuring language proficiency.



The Power of EdTech Tools:

Kognity's high school science curriculum provides spoken and written translations in over 130 languages!

Preserve the Military and Public Sector as Pathways to Upward Mobility

Help students recognize that science is integral to every aspect of the military. Studying STEM can give them an advantage in pursuing various roles within the military that interest them.

Studies show that the military has a long and financially significant effect on Black Americans, almost entirely closing the Black-White earnings gap. The benefits of military service extend across several other key social indicators: housing, education, marriage, and family.

Diversity of Perspectives in Science

Greater Access for All Students

Kognity for High School Science offers real-world, phenomena-based lessons that support diverse learners in every classroom with interactive 3D models, multilingual translations, and reading assistance. See how science departments across the country are using Kognity help all students gain scientific literacy.

[Explore Kognity →](#)

Phenomenon-Based Learning Checklist

Foster collaborative curiosity and Eureka moments with these pre-unit launch tips



Whether it's physics, chemistry, earth and space science, or biology, phenomenon-based learning empowers students to ask, "How do I know this?" by connecting real-life marvels to their experiences.

When executed successfully, this instructional approach sharpens students' questioning skills and drives classwide engagement by building a shared mission for deeper understanding. Creating this environment is just as much an art as a science.

Help your science teachers set a creative, exploratory, and collaborative tone with their students by following the steps outlined in this checklist before launching a new lesson.



Explore the Foundational Phenomenon

Purpose: To identify the events and as a learning community, figure out how to make sense of them.

- ☐ **Kick Off With Observation:** Lead your class in an initial exploration by asking, "What do we notice?" Encourage students to closely observe, seek out patterns, and even create a timeline of events.
- ☐ **Engage in Discovery:** Guide your students to become detectives, piecing together the clues they find. Whether they're spotting patterns or sequencing events, the goal is to uncover the story behind the phenomenon.
- ☐ **Create a Collaborative Learning Environment:** Foster a sense of community as your students work together to share what they've observed. The magic happens in this step—individual insights form a powerful collective understanding.

Attempt to Make Sense

Purpose: Allow students to explore and voice their initial ideas, setting the groundwork for deeper inquiry and understanding.

- ☐ **Draft an Explanation:** Encourage your students to dive deep into their scientific thinking as they craft explanations, models, or theories to explain the phenomenon. This is their chance to hypothesize and explore, no matter how unconventional their ideas might be.
- ☐ **Go Public With Ideas:** It's time for each student to share their thoughts with the class. Encourage them to put their ideas out there, fostering an environment where every hypothesis is valued and all contributions move the investigation forward.

Identify Related Phenomena

Purpose: Empower students to broaden their inquiry, making new and interesting connections that deepen their interest outside the classroom.

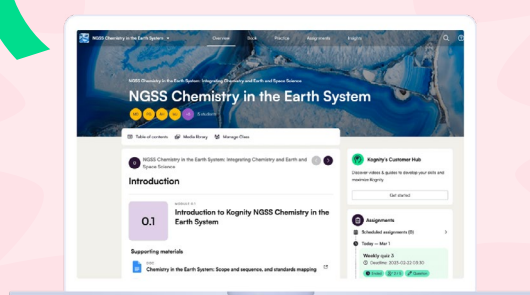
- ☐ **Expand Horizons:** Help students connect the dots between the phenomenon and a broader range of events. As they build up their DCI and CCC knowledge, they'll see the bigger picture and how this phenomenon fits into their world.
- ☐ **Build Personal Connections:** Encourage students to explore what truly intrigues them about the phenomenon. By making these connections, they become more invested in the exploration, making the learning experience richer and more engaging.



Pose Questions to Resolve and Discuss the Next Steps

Purpose: Equip students to take ownership of their learning by identifying actionable steps. This process drives the investigation forward and empowers students to be active participants in their scientific exploration.

- ☐ **Create a Driving Question Board (DQB):** Collaboratively create a list of questions and next steps to explore the phenomenon further. This step is where students can guide their learning journey, shaping the direction of the investigation.
- ☐ **Embrace the Ongoing Process:** The goal isn't to immediately find the perfect question or answer. Instead, encourage students to explore different avenues, knowing that the journey is just as important as the destination.



Kognity: NGSS-aligned Curriculum That Makes Science Approachable for All Students

Kognity's real-world phenomena-based curriculum keeps students engaged and future-ready, while equipping teachers with the skills and confidence to bring science to life in their classrooms.

[Reach out to learn more.](#)

The Power of Inquiry: Centering Student Experience and Real Life Application in Science Education

“

“Science is a way of thinking much more than it is a body of knowledge.”

Carl Sagan

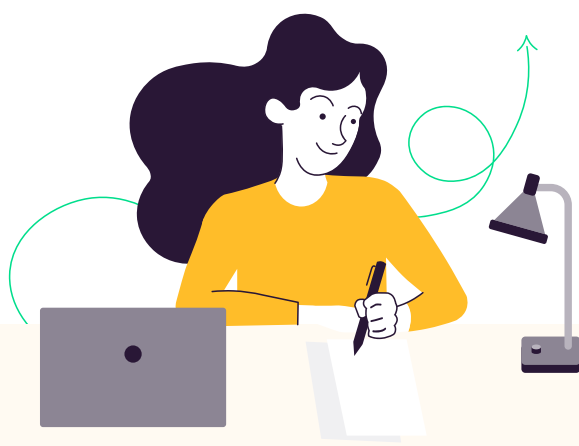
Scientist and Astronomer

In the past, our high school science curriculum has largely been concerned with a body of knowledge. The traditional model had students learning systems and vocabulary isolated within specific content areas: one year biology, the next chemistry, and so on. Each year of science felt as if it was taught in isolation: a set of skills, or study questions or concepts to learn and then repeat on an exam. To be immediately forgotten after all that hard work.

But in 2013, the Next Generation Science Standards (NGSS) were born. A framework that uses Inquiry-based learning (IBL) and encourages investigation as the model of instruction for students: discussion, problem-solving, and application—rather than rote memorization and fact-based lectures.

Inquiry-based learning has emerged as a powerful pedagogical approach in science education. By placing students at the center of their learning experience and encouraging them to actively investigate and question, this type of teaching and learning cultivates critical thinking, problem-solving skills, and a deeper understanding of scientific concepts. This not only benefits students as it fosters more authentic engagement with the subject matter, but the concentric nature of who this type of education will benefit, is far reaching in any community.

If the way we teach and learn remains the same instead of evolving with and better meeting community and global needs, the future of our workforce in the face of a rapidly changing employment landscape is uncertain.



Let's delve into how IBL in science benefits the entire community, including students, teachers, universities, and employers. By placing equity in learning at the forefront, we can envision a future where IBL becomes an essential element of an equitable science education.

Inquiry-based learning creates an inclusive, student-centered science classroom



While educators have long coveted the idea of autonomy in their classrooms, and are sometimes offered freedom to deliver content as they see fit, there has typically been less accountability as to whether or not each student is able to access the instruction. High school science education is not exempt from this.

According to an article by Aerospace America titled, [“Recognizing and Overcoming Barriers to Participation in STEM,”](#) the science and STEM opportunity gaps that exist among genders and different races are extremely prevalent and largely due to the way our systems have been set up in the past. This hypothesis makes visible that there are still barriers to participation in STEM education including “socioeconomic, self-perception, physical, institutional, and societal constructs — significantly impacting underrepresented or underserved communities, including individuals belonging to protected categories relating to race or ethnicity, gender, socioeconomic status...”



Inquiry- or phenomena-based learning, as outlined in NGSS, offers equitable access to high quality science education. The NGSS claims, “All Standards, All Students,” and asserts that all students will be able to see how science is relevant to their lives and how it can lead them to potential STEM careers. One of the things creators specifically wanted to address is society’s collective vision of who a scientist is and what they do. This vision is, in many ways outdated, and needs to be adapted as our societal norms continue to evolve and change.

By placing a focus on equity, and cultivating a three-dimensional culture in our science classrooms, we can ensure that all students can see themselves as, and think like scientists, and, through the work they begin in the classroom, develop like engineers. As we move away from placing an emphasis on the content, students can find success in planning and carrying out investigations. Teaching this way is more inclusive (of diverse student populations) and more engaging because it offers real world examples and applications. Ultimately, students are showing evidence of, more confidence, higher-level learning and a stronger interest in science and what it might offer for their future.

There is a strong argument which puts the core principles of diversity, equity, inclusion, and belonging at the center of student learning—exactly where it belongs. “If all students are known, heard, and supported with access and opportunities for rich science learning,” there is nothing they can’t do.



Educators as facilitators of investigation



Teaching can be overwhelming. Nothing has been highlighted more than this over the past few years. The level of burnout is high and teachers are leaving in large numbers every year.

Inquiry-based learning is a model that helps to shift the perspective of a classroom teacher away from an all-knowing lecturer. It offers teachers permission to engage students in more authentic learning and give them multiple ways to master the skills and knowledge necessary to figuring out the world around them. Teachers are recognizing that they can serve as facilitators of learning, while holding all students to the same high standards for mastery with a clear focus on critical thinking skills, naturally differentiated learning, and the encouragement of authentic ideas and experimentation.

In this article published in the [American Federation of Teachers](#), one educator highlights observations made in two different classrooms. The most notable difference was in a classroom that was engaged in inquiry or project-based learning. “In classroom 1 (traditional textbook and lecture), students ask only ‘what?’ and value answer making, while in Classroom 2 (IBL), students wonder ‘how?’ and ‘why?’, and answers serve as a stepping stone toward sense making. This shift equips students to not only learn new information but also apply it.”

Additionally, IBL encourages ongoing teacher training and development to master the art of guiding inquiry-based lessons effectively. Most educators are lifelong learners themselves and value the ongoing learning process in order to best serve their students. The professional learning that goes along with the shift to IBL means teachers experience greater job satisfaction as they witness their own growth, as well as students’ growth and enthusiasm for science.

Offering real-life examples of phenomena and then standing back while students make meaning of how this applies to their own life experiences, allows educators to be guides and students to be active participants in their own learning—rather than passive vessels of information.

Beyond the classroom: greater equity and opportunity for all



As our high school students move closer to their next step in the world—whether it's higher education or employment, we have to turn our attention to whether or not they are prepared for what they will encounter.



By offering students an inquiry-based learning approach in high school science, we are not only offering them examples of how and why they might use science and math-based knowledge and skills, but we are also developing critical thinkers who know how to ask questions about what's happening around them.

If students are better equipped in high school with science and STEM skills, universities can better collaborate with industry partners in order to align their coursework with the skills needed to thrive in an ever-evolving job market, ensuring more innovative thinking, and a more adaptable and capable workforce.

According to a [YouScience survey](#) of 500 high school graduates between 2019-2022, 30% of graduating students were not following any planned educational or career path. An inquiry-based high school science program can offer all students a more clear connection between what they are learning in class and how it can shape their future—in college or their career. When kids ask the age-old question of, “why am I learning this?” our instruction should be able to show them the direct effect it can have on their path. According to YouScience Co-Founder and CEO, Edson Barton, “Being more intentional in connecting lessons with careers, rather than having separate career-oriented and academic courses, can improve student engagement, graduation rates and clearer postsecondary pathways.”

Important to all community stakeholders, is the fact that a learning approach like IBL offers the potential to close achievement and [opportunity gaps](#) in science by [race/ethnicity](#). In a time of elevated awareness about the ways in which our traditional systems aren’t serving our most vulnerable members of society, changing the way we offer science instruction in schools—particularly high schools— is one way to ensure more inclusive and equitable access to learning and workforce skill development.



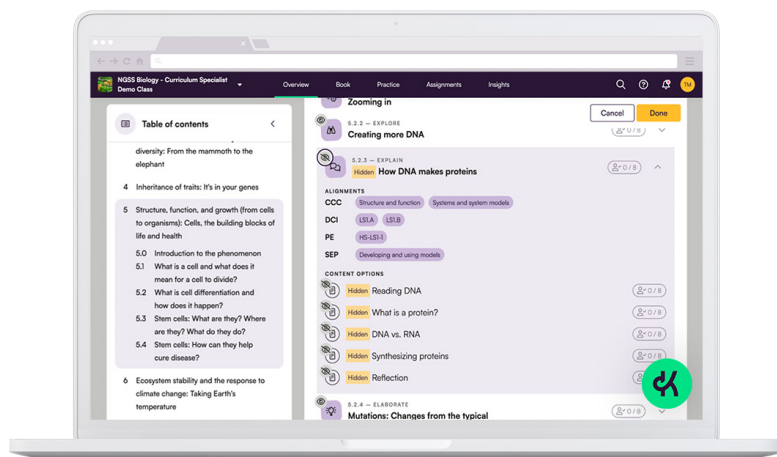
The Future of Equitable Learning in Science



While the focus of the NGSS always starts in schools, the reality is that the ripple it creates in a community is far reaching. The inclusive nature, foundational critical thinking and applicable research skills that students acquire when offered an inquiry-based learning approach in science, benefits an entire community. Students, teachers, universities and employers are all lifted by putting equity in learning at the forefront, and envisioning a future where this approach becomes an integral part of an equitable science education.

Enhance your inquiry-based approach with Kognity for High School Science, the proven core curriculum that ignites curiosity, fosters critical thinking, and unlocks deeper understanding.

[Contact us now for a demo!](#)



Resources:

[Thirteen Ways to Improve Science Education in the U.S. | Future of Learning & Work | Carnegie Corporation of New York.](#)

[Overview: How can we promote equity in science education? : StemTeachingTools \(en-US\).](#)

[About AAUW — AAUW : Empowering Women Since 1881](#)

[Increasing access and opportunity in STEM crucial, say experts — Harvard Gazette](#)

[Appendix D - “All Standards, All Students](#)

[Survey: Most high school graduates don’t feel prepared for college, career decisions | K-12 Dive](#)

[Overview: How can we promote equity in science education? : StemTeachingTools \(en-US\).](#)