Supporting Equitable Home-Based Science Teaching and Learning During Extended COVID-19 School Closures: Why we should lean into the assets of home-based learning.

What is the issue?

The global COVID-19 pandemic has led to extended school closures, many stretching through the end of the school year. With students and educators under shelter-at-home orders, states and districts are faced with difficult decisions about how to support students' science learning while they are home. Home environments support different aspects of student learning than school-based environments. Designing home-based learning experiences to intentionally take advantage of the unique assets of being at home can be supportive of students' social, emotional, and mental health; provide a meaningful and complementary science learning experience; and allow students to explore real-world and personally relevant science in ways that are difficult to accomplish in school. This resource was developed by members of the Council of State Science Supervisors to provide support around how to support student science learning during these unique circumstances, to be used in conjunction with other state and district decisions.

What does equitable home-based learning look like?

- **Equitable approaches to home-based learning contribute to key student learning goals.** Regardless of where science learning takes place, there are shared goals for science learning (Table 1). In addition, there are key features to the learning process and some unique qualities of specific settings that can be leveraged to support learning (Table 2). The quality of any learning experience—at home or in school, with or without technology—will depend on the degree to which it builds toward culturally significant learning goals through varied approaches that make sense within that context. Home-based learning environments may be well-suited to help students build toward learning goals that are often de-emphasized in classrooms, such as using science to address problems and phenomena that matter to families and communities.

Table 1 : Goals for Student Learning

Goals
● Students… ○ use science ideas and practices to **make sense of real-world phenomena and problems.** ○ are **scientifically literate** consumers of information, who see the **relevance of science to their daily lives** and the needs and priorities of their communities. ○ are **self-directed, self-aware, life-long science learners.** ○ are **empowered and confident** users of science to make changes in their lives and communities . ○ connect science learning to other content areas as a coherent set of ways to navigate the world. ○ are **prepared for a post-secondary world** that is increasingly dependent on scientific approaches.

Table 2: Key Features of Learning experiences.

Essential Features
● Developmentally-appropriate opportunities to engage: ○ with **relevant and meaningful phenomena and problems** that build toward learning goals. ○ regularly with peers and adults in **social sense-making,** productive challenging of ideas, and feedback cycles. ○ in **self-reflection and metacognition.** ● **Experiences use productive uncertainty** to drive student inquiry toward deeper learning. ● Access to **sufficient materials, resources, and expertise** to engage in **meaningful, coherent learning experiences** ● **Supportive physical and social-emotional environments** that allow students to prioritize and be present in learning

- **Effective home-based learning leverages the unique assets of students, families, and communities to frame and drive science learning.** Home environments allow students to deepen their understanding of science in flexible, meaningful contexts through interaction with family and community members. They offer phenomena

and problems that have authentic relevance to students' and their families' lives; offer the space and time to explore projects and engage in investigations that capture students' individualized, deep interests in more playful and relaxed ways; and offer opportunities to interact with family- and community-based expertise.

- **Home-based learning is most successful when students, families, and educators work together in complementary and collaborative ways.** Students, families, and educators all have key roles to play, including as they support meaningful home-based learning (Tables 3 and 4).

Table 3: Learning Roles.

	Roles in learning look more like…	**Roles in learning look less like…**
Students	● Being actively engaged in learning experiences. ● Engaging with peers to advance their own and others' learning. ● Playing an increasingly active role in directing their own learning.	● Memorizing and restating information. ● Learning by themselves, in isolation from peers.
Teachers	● Creating, selecting, and/or adapting instructional materials and experiences to be meaningful, relevant, and engaging to all learners. ● Providing opportunities for students to connect their science learning to their interests and identities. ● Expert classroom implementation with an eye to building coherence and progressive sense-making with peers and individually; ● Providing appropriate feedback and guidance mechanisms to move student thinking. ● Designing instructional experiences that encourage students to direct their own learning.	● Lecturing students "about" content. ● Devoting significant instructional time to learning experiences that lie outside of common learning goals. ● Providing childcare
Families and communities	● Supporting their children. ● Offering examples of process, phenomena, and problems from their own experiences. ● Providing thought-partnership to their children; acting as a co-learner. ● Offering expertise and varied perspectives. ● Supplementing school-based science with home- and community-based learning experiences that connect with students' interests.	● Designing or selecting science instructional materials or experiences. ● Leveraging research-based pedagogy to support science learning. ● Mimicking school at home during closures or extended absences.
Leaders	● Designing systems that attend to all learners, particularly those at the margins. ● Establishing space, time, and norms within which students and teachers operate. ● Establishing appropriate expectations and feedback systems to support the diversity of students, teachers, and families represented by the school community. ● Providing vision, leadership, priorities, and support.	● Advocating for systems or policies that work for many but not all learners. ● Establishing and enforcing expectations that run counter to effective teaching and learning practices.

Table 4: Roles family members or other learning partners can play in students' learning experiences

Encourager: provide positive feedback and support to students	**Resource Connector:** work with students to find materials and resources they need for an investigation or challenge	**Collaborator & Learner:** collaboratively work with student(s) on an investigation or challenge; make their learning process visible to students
Interest Supporter: talk to student(s) about their interests and how to pursue them	**Storyteller:** show how an idea or practice relates to another situation (e.g., a shared family experience)	**Organizer of Collaboration:** help coordinate the group learning process within the family
Knowledge Holder: communicate what they know about a topic or idea in ways that support students "figuring out" phenomena	**Audience Member:** friendly critic engaging with student products or presentations of an investigation or challenge	**Learning Broker:** connect learners to follow-on learning experiences that make sense, building on student interests and curiosities

This is adapted from work by Brigid Barron (Stanford University) and Nichole Pinkard (Northwestern University) by Bell, 2015, 2020.

What about school? [call out box]

Why shouldn't we just shift existing lesson plans to distance learning models?

School and home are not interchangeable learning environments. By encouraging teachers to maintain a pre-planned scope-and-sequence, and transpose lessons and learning goals to a home setting, leaders ignore the essential aspects of success for learning at home and at school. Successfully and equitably using distance learning to accomplish the same goals as school-based learning assumes that:

- all teachers are well-versed in facilitating this form of learning, and well-equipped to do so, and
- students have access to peers, educators, time, and materials in ways that closely approximate what they would experience in classrooms.

In many cases, neither of these conditions will be true; it will be quite rare for both conditions to be met. This is especially true as many systems shifted to learning at home with very little preparation time. As the current COVID-19 situation progresses, it will likely inform future planning and policies for creating the conditions to make more meaningful distance options available. When students are home for extended periods of time, leaders should encourage educators, students, and families to lean into the assets of home-based learning, rather than trying to unsuccessfully mirror school-based learning in environments that are not conducive to it.

Table 5: Features of School- and Home-Based Environments

	School-based environments	**Home-based environments***
What this environment provides	• **Professional classroom teachers** versed in science, pedagogy, instructional design, and classroom management; • Developmentally-comparable **peer-groups**; • Common **materials, time, and dedicated space** to engage in synchronous science learning; • Regular **routines and norms** for interaction that allow **coherent learning experiences** to build over time. • **Professional staff** well-versed in different aspects of **students' mental and physical health**. • Prioritized **academic learning goal**s across specific learning progressions.	• Family and community members with **real-world and culturally-rooted expertise**. • **Multi-generational** learning, collaboration, and communication opportunities. • **Flexibility** in schedules, workspace, resources, and routines. • Opportunity to learn science in **highly relevant and meaningful places**. • Opportunities to explore science through projects and activities that connect to **personal and community interests**. • Foreground **family- and community-based priorities for learning goals**.

***** *Note: one of the challenges of designing for home-based learning is the extreme variability of students' home lives; the most challenging and vulnerable environments should be considered when making decisions about supporting student learning.*

What role *should* teachers be playing?
Teachers have deep pedagogical and educational expertise that enables them to **architect meaningful, coherent learning experiences that deepen understanding over extended lengths of time:** they know where students are going, how to diagnose student progress, and how to support students to reach the desired learning goals. When supporting home-based learning experiences, teachers should consider providing the roadmap or guardrails for projects and investigations that take advantage of the assets of home-based learning; designing work that students can pursue flexibly, asynchronously, and within a variety of home lives; offering choices for assignments that allow students to explore something that matters to them; prioritizing feedback and guidance during check-ins with students; and leveraging available technology to lean into the essential features of learning (Table 2).

Is school obsolete? Does this mean that all science learning can happen at home?
Helping students meet their goals in science requires **both** school- and home-based learning. Under ideal circumstances, school-based and home-based learning intersect in ways that meaningfully complement each other. While leveraging the assets of home-based learning as a primary route to science learning makes sense while schools are closed and students, families, and teachers are at home, we should be cautious about assuming that all science learning can be accomplished at home. The unique strengths of school-based environments (Table 3) are essential for complete student learning experiences.

[End call-out box]

Attending to Equity

- **Social-emotional health of students, educators, and families will impact learning at this time.** Our communities are suffering right now. Students, families, and educators are under a great deal of stress during these uncertain times. Adults (families and educators) may be juggling child-care and work responsibilities, and an increasing number of families are experiencing sudden loss of employment. Students may find themselves supporting family needs by working within and outside the home. Social distancing is limiting the social supports both students and adults might normally rely on to cope with these stressors.

- **Teachers, families, and students need to be supported in shifting toward home-based paradigms.** Remember that the expertise of students, teachers, and families is contextualized, and that their experience has not likely been tested under such circumstances in the past. For families, this may mean that while they are equipped to support student science learning that is primarily done in the classroom, they may not be prepared to take on a teaching role at home. For teachers, this may mean expertise in implementing high-quality science learning in the classroom, but a need for professional learning and support to do this well in remote (digital or analog) environments, without access to the features school-based learning offers.

- **Families will have different availability and resources to support student learning in meaningful ways**. As systems and schools make recommendations for learning at home, it may be difficult to address the high degree of variability in students' homes. Families will have varying levels of time, technology, or other physical resources, like books or hands-on materials. Leaders should provide options for supporting all families and question their own assumptions at each step.

- **Not all homes are safe learning environments**. Students may be in unstable housing, lack sufficient access to food or running water, or may be experiencing abuse that is exacerbated by sheltering-in-place. To the extent possible, leaders should work with communities to ensure that students have access to fundamental safety and security. Students should not be penalized for work that can not be completed.

Recommended Actions:

- Help colleagues at the state and in districts consider trade-offs carefully and make intentional decisions that make sense for the students, families, and teachers in the community.
- Empower families and students through sharing resources and tips, including those translated into home and heritage languages.
- In safe ways, students should engage in home-based science investigations and engineering design challenges in collaboration with learning partners that are available (see below). Students should be supported in the science and engineering practices in ways that fit the home context. These practices in a home-based context tend to be integrated with other culturally-rooted practices and ways of talking of the family and their community.
- Consider the range of roles that families and other learning partners can play in student learning (see Table 4). Advocate for home-based learning that leverages these roles as assets in students' science experiences. Siblings, parents, relatives, or teachers can play productive roles at different times as students engage in a science investigation or engineering design challenge. Different individuals will be able to support learning at different times, in different ways.