Maintaining High-Quality Science Education in Distance Learning/Hybrid Models

Position Statement
Approved by the
CASE Board of Directors
January 20, 2022

california association
of science educators

Issue

Whether it's in-person, remote, or hybrid learning, it is essential that both synchronous and asynchronous schooling significantly enhance science teaching and learning so that all students have access to high-quality science and engineering experiences.

Now more than ever, when there is a pervasive lack of scientific literacy and social justice in our society, we need to provide all students with authentic and relevant experiences and help them make sense of real-world phenomena, and address real-world problems. Lessons learned about distance/hybrid teaching and learning during the COVID-19 pandemic can be applied when future events lead to a return to remote learning as the predominant schooling approach.

The pandemic has exacerbated inequities in students' access to high-quality learning experiences in science. In addition, because of physical school closures due to COVID-19, districts have reversed the small gains made in science instruction and again prioritized mathematics and English Language Arts instruction at K-5. Educators must help students address the present and future challenges by working together to support them in their science and engineering learning at the TK-12 level.

Background

Humanity is facing global challenges on an unprecedented scale that have widened social-economic disparities and devastated many of the world's most vulnerable communities. The environmental and health impacts of climate change and the COVID-19 pandemic are two illustrations of the challenges that we face. Addressing these challenges will require innovative solutions and the scientific and technical workforce to create them. In addition, solutions need informed governmental leaders who understand the value of science to make evidence-based policy decisions and an informed public who is scientifically literate and can use science to guide personal and societal choices.

In spring 2020, the COVID-19 pandemic presented an unprecedented challenge to schools throughout the country: to continue to teach the nation's TK-12 students without having them physically present in the classroom. Many Local Education Agencies (LEAs) and teachers rose to the challenge of distance learning, pivoting to meet the new instructional demands creatively. There were successes through innovative approaches, where teachers could take advantage of new levels of flexibility and technology to provide engaging learning opportunities for their students. Synchronous remote learning—students and teachers working simultaneously—can help provide real-time collaboration among students and interactions between students and a teacher, allowing the teacher to shift instruction immediately in response to student needs. Asynchronous learning offers flexibility and differentiation for students: those who need more time can take it, and those who are ready for more challenges can extend their learning.

Now more than ever, when there is a pervasive lack of scientific literacy and social justice in our society, we need to provide all students with authentic and relevant experiences and help them make sense of real-world phenomena, and address real-world problems.

However, for many, it remained a challenge. The pandemic conditions posed significant obstacles to investigations and hands-on experimentation, particularly having students work effectively in collaborative groups. If students are primarily learning at home, they generally will lack the necessary tools and materials.

A July 2020 survey conducted by WestEd indicated that less science instruction was happening during remote learning than pre-pandemic times. They found that 88% of teachers were spending somewhat or significantly less time on science. The study also found that most students were not afforded the ability to engage in experiments or investigations of the science instruction being taught. Of the teachers surveyed, only 38% of teachers reported students were engaged in experiments or investigations during distance learning.

Position Statement

High-Quality Teaching and Learning

While the educational conditions might change, three-dimensional teaching embodied within the Next Generation Science Standards (NGSS) remains the most effective guide for implementing high-quality science and engineering education. Teachers and students need to integrate and weave together the Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs). An April 20209 report from ***NextGenScience at WestEd*** described eight strategies that can be used to adapt K-12 three-dimensional lessons for distance learning.

1. Introduce phenomena through independent pre-work.
2. Ensure all students can experience and explore phenomena as directly as possible.
3. Provide discussion questions in written form to support student development and use of the three dimensions.
4. Provide a central space for students to track three-dimensional thinking and revise ideas over time.
5. Leverage additional home connections.
6. Provide students independent time to formulate questions and ideas to drive the next step in learning.
7. Elicit student ideas through discourse and writing in both synchronous and asynchronous environments.
8. Connect current learning to specific activities from prior lessons across all three dimensions by using pictures when classroom artifacts aren't available.

The Role of Agency in Distance Learning

Educators' response to the COVID-19 crisis highlighted their capacity to draw on their professional knowledge and collaboratively mobilize with flexibility, innovation, and creativity. Therefore, the educational system must encourage conditions that support teacher collaboration and professional learning, as they are vital components for teacher growth and are essential during challenging times.

Declarations

CASE believes that there are many creative opportunities to leverage learning assets from home and in the community by using physical and technological resources in distance and hybrid learning situations.

Local Education Agencies (LEA) must support educators with:

1. Collaborative planning time and

2. Professional learning to improve distance learning experiences for all students, including strategies for:

- incorporating students' background, community culture, and perspectives in meaningful ways in science and engineering instruction
- providing explicit instruction to students on social and emotional skills, habits, and mindsets
- facilitating student discourse to support sense-making and language development in digital settings
- providing constructive feedback through formative assessment in distance and hybrid learning situations
- focusing on the instructional core, including science and engineering at the TK-5 level
- converging lessons that integrate science with mathematics and language arts
- engaging family by supporting at home/kitchen science and engineering

During online/remote learning:

Students can:

- Make predictions and ask questions about a local phenomenon.
- Observe, collect data, and make sense of the natural world.
- Make claims based on evidence and communicate explanations.
- Utilize crosscutting concepts to deepen their understanding.

Teachers can:

- Use students' interests and contexts to select relevant and engaging local phenomena.
- Plan together to maximize cross-discipline learning opportunities
- Provide students with opportunities and scaffolding to engage in collaborative sense-making.
- Collect information about where students are in their understanding and provide formative feedback that supports student metacognition.
- Utilize/modify effective practices such as instructional storylines, ***driving question boards, academic discourse***, etc.
- Engage students with simulations, videos, demonstrations, etc., in lieu of hands-on experiments for scientifically relevant observations, data collection, and modeling when necessary.
- Slow down and prioritize three-dimensional student sense-making, increasing depth of learning even if it means decreasing breadth of topics.

REFERENCES

- National Academy of Sciences: Teaching K-12 Science and Engineering During a Crisis (2020) prepublication
  - ***Report***
  - ***Webinar***
- Council of State Science Supervisors: ***CSSS Community Projects***
- WestED Survey (2020): ***Science Learning During Covid-19 and Beyond***
- WestEd: ***Keep Teaching Science***
- Learning in Places: ***Family Learning Engagements***
- CASE Policy Statement "***Providing Equitable Instructional Time for High-Quality Science in Elementary School***"
- ***The Right Question Institute Remotely***
- ***Supporting Students' Science Learning During COVID-19 School Closures: StemTeachingTools (en-US)***