

Strategies Matrix

(<https://tinyurl.com/SPLS-Strategies>)

The [Science Professional Learning Standards \(SPLS\)](#) apply to all professional development and professional learning regardless of the platform used for delivery of professional development and engagement in professional learning. Evidence from research shows that high quality professional development can be delivered via distance learning; however, there are a number of challenges associated with online delivery. The strategies below provide insights into how online learning can be delivered in ways that meet the SPLS and the needs of professional educators.

	Standard	Strategies for Online PD and PL
A 1.	Support educators to develop strategies for eliciting, interpreting, and making use of students' reasoning to inform their science teaching.	<ol style="list-style-type: none"> 1. Model class discussion by posing questions with different purposes by using a variety of technologies (e.g., polling, chat box, online survey) to elicit and record initial student thinking. 2. Facilitate the use of annotation tools to conduct collaborative analyses of student work to identify evidence of student thinking. 3. Use multimedia tools to invite teachers to share stories and reflections about key learning moments when students are engaged in science investigation and engineering design. 4. Evaluate different technology tools (e.g., polling, drawing tools, surveys) for eliciting student thinking by using them in professional learning and then discussing the strengths and limitations of the tools for eliciting three-dimensional reasoning. 5. Model how to evaluate student reasoning within class discussion by collaborative analysis of artifacts generated through online interactions (e.g., chats, virtual student work). 6. Analyze and discuss videos depicting the variety of ways students can express their ideas to develop skills in recognizing diverse sensemaking repertoires of students using video annotation tools. 7. Analyze teachers' responses to students' ideas and questions presented in videos of classroom instruction and use video annotation tools to evaluate effective classroom discourse that makes student thinking visible. 8. Analyze artifacts of student three-dimensional work using small group discussion in a shared document to brainstorm appropriate instructional action.
A2.	Be sustained over a long duration and provide repeated opportunities to plan, implement, and reflect on teaching strategies in science classrooms that engage students in	<ol style="list-style-type: none"> 1. Establish norms and practices for the effective use of online sharing tools to engage participants in active and relevant learning experiences that result in long-term science learning communities. 2. Model three-dimensional teaching in the sequencing of activities and in how technology is used to support collaborative engagement in science and engineering practices to figure out core ideas and crosscutting concepts. 3. Engage teachers in ongoing and evolving synchronous or asynchronous analysis of video clips of classroom instruction to reflect on specific aspects

	three-dimensional science learning	<p>of three-dimensional teaching and learning.</p> <ol style="list-style-type: none"> 4. Provide regularly scheduled virtual opportunities for focused instructional strategies that enable teachers to plan synchronously, to implement, gather, and share formative data asynchronously, and reflect collaboratively on the strategies synchronously. 5. Use strategies to prevent fatigue and motivate sustained engagement, such as breakout groups, breaks, and offline activities when engaging educators in synchronous online professional development that spans multiple days, months, or years. 6. Use capabilities of digital environments to enable people to choose multiple pathways in which each incorporates increasing levels of challenge, follow the pathways at their own pace asynchronously, and be recognized for their accomplishments with certificates, digital badging, state inservice credit, and/or graduate credit for participating in long term professional development.
A.3	Provide opportunities for school-level educator groups to discuss and coordinate efforts to design and implement coherent teaching across multiple years.	<ol style="list-style-type: none"> 1. Use digital annotation tools to collectively identify grade specific three dimensional learning goals through the analysis of learning progressions across grade bands to ensure coherence of learning across K-12 learning through synchronous and asynchronous discussions. 2. Use a combination of collaborative design tools (e.g., Jamboard, G-docs) to plan, review, and adapt coherent sequences of instruction or instructional materials. 3. Work collaboratively in school-based professional learning teams via online small-group breakouts to clarify how core idea understandings, science and engineering practices, and crosscutting concepts expectations progress across grade-levels.
A.4	Prepare educators to connect science learning with students' interests and experiences	<ol style="list-style-type: none"> 1. Model the use of an online survey and polling tool to assess student interests/experiences for purposes of determining relevant phenomena for use with a specific learning goal. 2. Use online collaboration tools to engage teachers in analyzing and evaluating data from student interest inventories. 3. Engage in virtual book or article club discussions to share strategies for teaching culturally relevant science investigation and engineering design. 4. Organize live online sessions with geographically and culturally diverse groups to discuss analogous phenomena that have the same scientific explanations. 5. Model strategies for teachers to engage students in observing, photographing, digitally representing, and sharing through virtual structures culturally and locally relevant phenomena from their everyday lives 6. Use scaffolded online interactions to model effective strategies for fostering student agency with at home science and engineering investigation. 7. Engage parents and community organizations in a synchronous discussion of phenomena and design challenges that can link home and school more coherently and productively in remote teaching.

A.5	Integrate strategies that promote equitable participation in science learning for all learners.	<ol style="list-style-type: none"> 1. Establish procedures for participants that can make people feel comfortable about asking questions and sharing their thoughts about their own learning by using chat-based or breakout check-ins for participants. 2. Integrate strategies for ensuring all people have a chance to speak in meetings; in synchronous discussions, for example, have speakers nominate the next speaker until all have had a chance to share. 3. Enable various ways and channels for people to express themselves, to model multimodal expression (in writing offline and typing, audio or video recording, offline and online drawing). 4. Use polling software and online virtual white boards to enable all participants to respond to important questions. 5. Invite participants to share leadership roles within virtual breakout groups and reporting out for the group. 6. Use a virtual daily or activity-level survey that includes items related to the degree to which participants' questions were adequately addressed and contributions were respected.
A.6	Model teaching strategies and curriculum materials that are consistent with the desired shifts in teaching and learning introduced in professional learning.	<ol style="list-style-type: none"> 1. Provide standards-aligned curriculum resources that are consistent with the goals for professional learning, accessible online, and modifiable for remote learning. 2. Support small-group synchronous adaptation of high-quality three-dimensional materials designed for in-person teaching to use in hybrid or remote learning environments.. 3. Model how to adapt collaborative routines for sensemaking, collaborative knowledge building, and discussions to synchronous and asynchronous learning environments. 4. Engage teachers with novel collaborative learning technologies (e.g., Jamboard, other collaborative drawing tools) to model experimenting with, documenting, and learning new technologies. 5. Engage teachers in virtual rehearsal for the use of curriculum resources and peer-reflection through small grade level specific online groupings of teachers to foster best use of instructional materials. 6. Encourage teachers to share stories and artifacts of standards-aligned curriculum implementation through blogs and other online tools. 7. Enable educators to engage in investigation and engineering design from school or home by providing necessary materials and equipment prior to the online sessions.
A.7	Accommodate participants' varying levels of experience in supporting three-dimensional science teaching and learning.	<ol style="list-style-type: none"> 1. Conduct surveys of participants to create virtual small groups that are at times heterogeneous and at other times group individuals with similar questions and/or experience with the standards. 2. Identify, prepare and share resources over virtual platforms with participants at different levels of expertise before, during, and after the professional learning sessions. 3. Prepare learning experiences for different small-group breakouts linked to different questions and concerns. 4. During the session, use quick formative assessment polls related to both learning targets and participants' learning experience.

		<ol style="list-style-type: none"> 5. Adapt use of technology tools based on the different confidence levels of participants, to ensure all participants are able to focus on the substance of professional learning. 6. Support teachers' online technology needs by using co-presenters and secondary communication platforms (e.g., chat, email, telephone) to help individuals with technology issues.
A.8	Connect ideas and teaching strategies introduced during the professional development experiences to educators' current beliefs, teaching strategies, and goals for learning.	<ol style="list-style-type: none"> 1. Use digital tools to conduct needs assessments about teachers' experience, goals, and beliefs about online teaching and learning consistent with the <i>Framework</i> to plan effective online professional development before professional development. 2. Elicit formative feedback from teacher experiences using online discussion groups and polling systems. Share this feedback in digital representations as it relates to instructional shifts throughout professional development . 3. Use small breakout sessions and other virtual discussion spaces (e.g., Jamboard, google documents) to provide opportunities for discourse and reflection on ideas and teaching strategies educators are learning that could apply to their own instruction throughout professional development. 4. Use email, brief online surveys, and chat to elicit information about how the experiences have changed their instructional practices after the conclusion of professional development..
A.9	Incorporate curriculum connections among state standards for science, mathematics, English language arts, and social studies.	<ol style="list-style-type: none"> 1. Choose virtual tools that can support knowledge-building and engagement in practices across a range of disciplines. 2. Model instruction that integrates learning goals from multiple disciplines, including three-dimensional science standards, by using live online sessions that include opportunities for teachers to engage in investigation and design. 3. Invite teachers from multiple subject areas to collaborate virtually to analyze, discuss, create, and adapt materials using annotation and collaborative writing tools that are interdisciplinary and can address multiple curricular goals.

General Strategies

The following strategies provide insights for ways to enhance the quality and effectiveness of professional learning.

- Plan professional learning sequences to increase participation and reduce digital fatigue. Spread out learning across longer time frames with shorter events. Maintain schedules that include regular breaks and time away from screen.
- Design time to foster deep learning and build relationships within learning communities.
- Establish clear goals, expectations, and routines for appropriate interactions during each phase and type of professional development episodes by using a full group presentation of norms, posted documents of goals and expectations, and email communications (eg. engaging facilitators for small group sessions to ensure talk protocols are followed).
- Facilitate and respect the contributions of individuals in the sessions without changing the message of professional development.
- Use technology to engage participants in diverse ways of contributing and making sense of experiences of professional learning.
- Use both large and small group structures to engage teachers in doing investigations.
- Organize small groups into sizes that promote individual participation in the breakout groups. Ensure the first time in a given small group that there is enough time for participants to also introduce themselves.
- Use multiple co-presenters to help manage the online sessions and establish clearly designated roles even if they change throughout the session.
- Hold rehearsals with co-presenters where you clarify flow and roles.
- Use shared documents as a way to monitor progress in the breakout groups and prepare relevant discussions when the groups return to the full class discussion.
- In large professional learning sessions, ensure that you have a shared document that acts as a hub to direct participants to different virtual spaces. This may be different virtual links so that you can break people out to further small breakout rooms.
- Establish consistent routines for the delivery of professional development and interactions of participants.
- Acknowledge the diverse needs of folks working from home and extend grace to those needing to step away if needed.

Technology Tools to Support Learning

These tools are examples of ways to support professional learning, as well as to support collaborative learning with students. Ideally, teachers gain practice collaborating with peers, in preparation for using these tools with students. In the table, we highlight tools in which professional learning can model how to support students in 3D science learning. That is, the tool descriptions focus on how it can be used to engage participants in sensemaking related to a phenomenon or problem under study using the science and engineering practices.






Before considering specific technology tools, there are several hardware considerations including:

- If possible, have two screens or two computers available for the person sharing a screen.
- Give people instructions to mute microphones and ensure one of the co-presenters is assigned to mute if needed.
- Ensure that you have sufficient bandwidth when leading presentations. In areas with limited bandwidth or power fluctuation issues:
 - Have people shut down video when necessary
 - Dial in with your voice to ensure stable voice connection
 - Share the slides with participants/co-presenters










When using any technological tools, such as the tools below, use different protocols for privacy and security. Consult your state and district policies before using any of these tools to ensure that the privacy and security protocols meet the requirements of those policies.

When selecting online tools for collaboration, analyze and make use of familiar tools first, before introducing new tools that would require educators to learn both a new tool and a new pedagogy consistent with the vision of the *Framework*.







We have included tools that support engagement in a variety of media (see [UDL guidelines](#)), including text, speech, drawing, illustration, comics, storyboards, design, and video. The following icons are used to guide users to tools for specific forms of engagement:

 Writing or other textual;  Speech, discussion, peer-peer talk;  Drawing, illustration, comics, storyboards, design;  Film, video, visual art, sculpture, dance, movement;  Music




Collaborative Knowledge Building Tools

<p>Padlet - A virtual shared whiteboard where participants can upload different kinds of media to post to a sticky that can be moved around</p>	
<p>Google JamBoard - Participants use the JamBoard to write their individual observations and questions in a common space, using text or pictures. The tool makes it easy to rearrange stickies into groups and add text to create labels for categories of questions</p>	
<p>Pinup - An application that allows users to post sticky notes to a common board and move them around. Can upload a picture or document to the board</p>	
<p>Nearpod - Allows participants to post and respond to their peers. Easy-to-use tool for creating interactive lesson plans, presentations, assessments, and digital content. Nearpod allows for the creation of digital activities and for tracking individual progress on those activities.</p>	
<p>Vialogues - Participants can annotate phenomenon videos (youtube, Vimeo, or teacher uploaded) with their observations and questions.</p>	 
<p>Videoant - Participants can annotate phenomenon videos (if a youtube video) with their observations and questions.</p>	 
<p>Google Docs with Tables - Provides an easy way to organize participant thinking by prompt or category. Participants can compare an individual's ideas in a structured way.</p>	



Presentation and Drawing Tools

<p>Google Drawings - Useful for creating flow charts and models showing relationships and dynamics among components of a system, and system models.</p>	
<p>Google Slides - Provides a way to present professional development with coherent information and performance sequences. Slides can be used by participants to collaborate to develop and present explanations and arguments.</p>	 
<p>Pear Deck - An extension of Google slides that allow for interactivity within slide decks from participants, such as enabling students to add to a model on a slide, or add evidence to support an explanation.</p>	
<p>Youtube - Use Youtube's "copy at time" feature to send participants to a very short section of a longer video to make observations of a phenomenon.</p>	
<p>Edpuzzle - Use video of phenomena or related phenomena. Trim essential content and insert key breaks with prompts for participants to stop and jot. Can also insert other app links to poll participant thinking.</p>	






Discussion-Specific Tools

Kialo - Supports position-driven argumentation, where participants can articulate evidence to support arguments for different points of view.	
Flipgrid - Facilitate discussions/reactions via video. A question can be posed by the facilitator and participants respond to the question via a video. Participants can also respond to each other's videos.	
Now Comment - A document-annotation and -discussion platform that allows participants to mark up and discuss texts.	


Storyboarding Tools



MakeBeliefsComix - Tool for creating comic strips, which can be useful for allowing participants to represent sequences in an investigation or an unfolding process	
Storyboard That - A tool that allows participants to create storyboards and tell digital stories	

Shared Writing and Annotation Tools


Hypothes.is - A tool that allows you to annotate a web page or upload a document and that allows participants to annotate different parts of it with notes, and to comment on others' annotations. Can be used to identify information related to a phenomenon being studied, make sense of a complex scientific text, and paraphrase ideas.	
Kami - Kami allows participants to annotate any PDF to identify information related to a phenomenon being studied, make sense of a complex scientific text, and paraphrase ideas.	
Google Doc - Students can compose text together or edit and comment on others' writing. Scientific texts can be imported and students can use comment features to identify main ideas, evidence, or evaluate claims in texts.	
Now Comment - A document-annotation and discussion platform that allows participants to mark up and discuss texts.	
GoReact - Teachers can annotate videos of practice collaboratively online	

Assessment - Polling Tools

Poll Everywhere - Use as a live tool to ask participants to say what they think and then vote up or down peer ideas. Subscription will allow custom URL and reporting features.	
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<p>Zoom Polls - Embedded within zoom professional accounts to allow synchronous polling during meetings.</p>	
<p>Google Forms - Use Google Forms to construct brief assessments at different points both synchronously and asynchronously in learning sequences.</p>	

Reflection about Professional Development and Engaging in Professional Learning

<p>Google Doc - Documents with prompts that allow teachers to reflect on their own learning and growth can support integration of learning and connecting to prior experiences, knowledge, and beliefs. Teachers' reflections can be gathered in tables to support looking across different teachers' ideas.</p>	
<p>Flipgrid - Facilitate discussions/reactions via video. A question can be posed by the facilitator and participants respond to the question via a video. Participants can also respond to each other's videos.</p>	