

Design Decisions in Translating Face-to-Face Video-Based Elementary Science Professional Development to an Online Environment

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BSCS Science Learning and The University of Minnesota



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What is STeLLA and Why Online?

Science Teachers Learning from Lesson Analysis

(Roth et al., 2011)

- Video-based professional learning (PL)
- Originally designed as fully face-to-face
- Integrates science content, curriculum, and pedagogy
- Organized by the STeLLA Framework
 - Science Content Storyline Lens
 - Student Thinking Lens

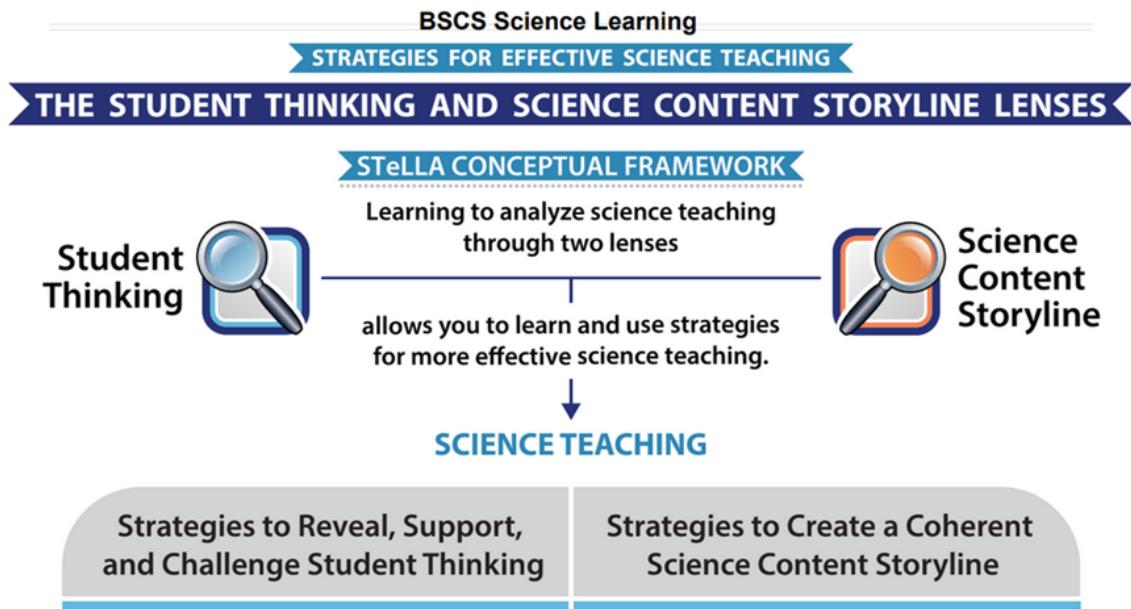


Figure 1. The STeLLA Framework

- Embodies STeLLA Design Principles (Roth et al., 2017). We highlight three in this presentation.
 - Integration of science content deepening, curriculum, and pedagogy in PL
 - Collaboration and community
 - Facilitation requires extensive expertise
- Approximately 90 hours
- Extends over a full calendar year

Evidence for Face-to-Face STeLLA

- Cluster randomized trial (Taylor et al., 2017; Roth et al., 2019)
- Strong impact on student science achievement ($\delta_T = 0.52$; $p < .001$)
- Strong impact on teacher content knowledge (Hedges' $g = 1.17$; $p < .001$)
- Strong impact on teacher classroom practice (Hedges' $g = 2.05$; $p < .001$)

Challenges of Face-to-Face STeLLA Model

- Requires travel
- Requires two-week full-time commitment from teachers in the summer
- Difficult to reach teachers in small, rural districts

Why Move STeLLA Online?

- Increase reach while maintaining efficacy
- Increase accessibility for teachers
 - Eliminate forced choice between a summer job and STeLLA
 - Eliminate need for childcare for two weeks in the summer
 - Eliminate travel costs
 - Eliminate facility costs
- Make access to STeLLA more equitable

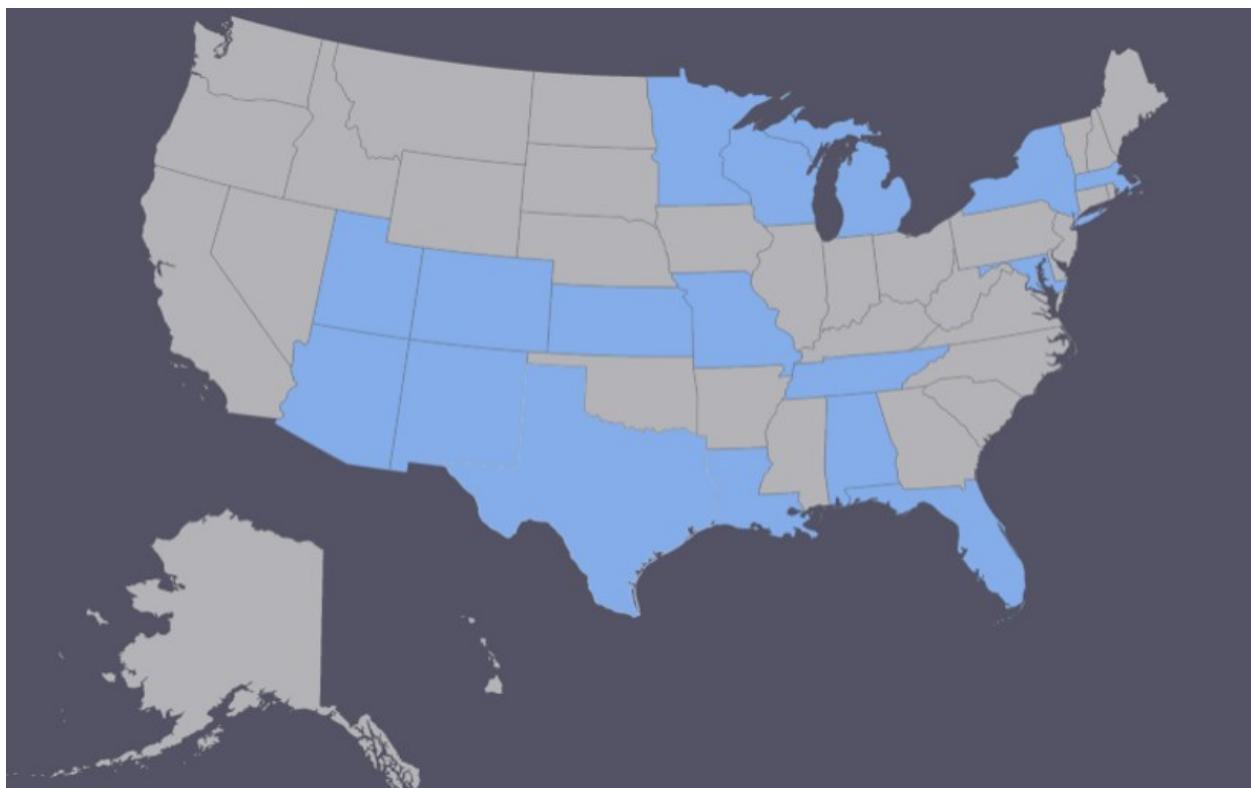


Figure 2. This map shows states (in blue) where participating STeLLA Online teachers work and live.

STeLLA vs. STeLLA Online

- Same total duration (~90 hours)
- Intensive summer experience (both)
 - Concentrated in 2 weeks (face-to-face)
 - Spread out over 10 weeks (online)
- Video analysis of non-participating teachers in summer (both)
- Video analysis of own and peers' classrooms in fall (both)

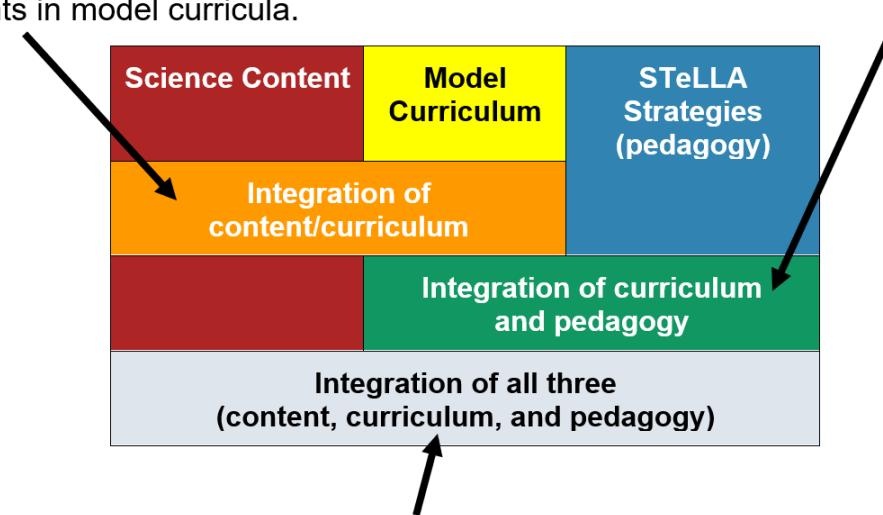
- Lesson development in winter (both)

Integration of Science Content, Curriculum, and Pedagogy in Online PL Experience

As in face-to-face STeLLA, we carefully integrated teachers' science content learning, curriculum materials, and pedagogical learning experiences. Integration required careful attention during development of STeLLA Online.

Engaging as learners using science activities that are closely matched to experiences of students in model curricula.

Analyzing model curriculum units for their use of STeLLA strategies.



Analyzing students' science ideas or coherence of a science storyline in video as surfaced through STeLLA strategies as students engage in model units.

Five Part Asynchronous Module Structure

(colors correspond to levels of integration in image above)

1. Learn focal strategies. Study 2 or 3 STeLLA strategies, engage in asynchronous discussion, and submit copies of STeLLA Strategies Summary Table to facilitator. Crux Question: How do the focal strategies this week differ from each other?

2. Engage in science. Engage in curriculum-based science activities (matched closely to model lesson). Crux Questions were lesson specific. Example: When water boils, what's in the bubbles?
3. Analyze video. Analyze video of teacher using focal STeLLA strategies while teaching model lesson. Asynchronous video analysis emphasized identifying strategies using video and transcripts (first level of analysis).
4. Use and apply. Teachers consider how they might use the focal strategies to teach science ideas related to the model unit and submit a Canvas assignment or engage in an asynchronous discussion.
5. Reflect. Reflection on science content (driving question board), strategies, and relationship between strategies and lenses.

Five-Part Synchronous Module Structure

Two-hour Video-Conference Sessions

1. Check-in: How are you doing, really? We spent 15 to 20 minutes each synchronous session checking in.
2. Review meeting norms.
3. Discuss focal STeLLA strategies with discussion designed to highlight challenges that emerged during asynchronous work.
4. Analyze videos showcasing curriculum, science ideas, and focal strategies
5. Discuss science ideas in greater depth (in the context of learning activities matched to curriculum)

Facilitation of STeLLA Online

Analyzing Video: Face-to-Face vs. Online

Video Analysis in Three Steps

Note: Prior to analyzing video, teachers have read from a booklet that describes two or three focal strategies for the week.

Step 1: Identify focal strategies. Teachers watch the video and use time stamps from the transcript to create a shared image of the strategy.

Face-to-face: Work silently and individually in a large group setting, marking up a transcript. Then share examples using time stamps.

Online:

- **Part 1** - Work individually in an asynchronous setting, then share examples in asynchronous discussion.
- **Part 2** - The facilitator studies discussion posts for areas of confusion **and leverages asynchronous posts in synchronous session.**

Step 2: Analyze video to consider its impact on students.

Face-to-face and Online: Individually spend 5-7 minutes analyzing the transcript. One participating teacher shares her claim, evidence, and reasoning. Other teachers in the room add on by agreeing, disagreeing, and/or offering an alternative claim. Discussion continues with another teacher sharing another claim. The online discussion takes place during the synchronous session via video-conference.

Step 3: Reflect and apply to make strategy part of own practice.

Face-to-face and Online: Teachers spend 2-3 minutes silently writing their reflections, carefully attending to how they might apply what they have learned to their own classrooms. Takes place in the 2-hour synchronous session in STeLLA Online.

Figure 3 (video link). Example video with [transcript](#)

[VIDEO] <https://player.vimeo.com/video/356741509?byline=0&badge=0&portrait=0&title=0>

Figure 4. Example of Step 2: Analyze video

Analyze the Video (Example)

Make a claim that answers one of the two analysis questions.

*My claim is that the teacher attended to **Strategy F: Make explicit links between science ideas and activities** by eliciting ideas before the activity (Set-Up), making links between the activity and the science ideas as student groups were working (During), and summarizing the key science ideas from the activities after (Follow-Up).*

Provide evidence from the transcript to support your claim (time stamps).

At timestamp 1:06, he elicits ideas before the activity starts and at 1:42, he emphasizes that students should keep the focus question in mind as they conduct the activity. At timestamps 2:40 - 3:16, he helps students connect tumbling, breaking rocks in a bottle to rocks tumbling down the hill and then reconnects it to the focus question. At 17:42 the teacher asks students to summarize ideas to follow-up the activity.

Provide reasoning: Connect your claim and evidence with reasoning based on the STeLLA strategies, research on teaching and learning, your teaching and learning, or scientific principles.

Students were provided key opportunities to build a science content storyline by the teacher's attention to Strategy F. By drawing out student ideas before the activity, continually drawing them to the key science ideas during the activity, and allowing students to summarize ideas at the end, they know why they are doing the activity and what they should be learning from it.



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Key Facilitation Differences -

Timing and Crux Questions

A key difference in facilitating face-to-face STeLLA and STeLLA Online is the timing. In face-to-face, the facilitator listens and guides participants in the moment. If teachers misidentify a strategy during the Identify phase of video analysis, then she may push teachers to support their answer with evidence from the strategy book or seek input from other teachers in the room.

Online facilitators leverage asynchronous discussions in synchronous sessions. The facilitators take the time to carefully read teachers' posts and use them to plan a discussion. The responses to participants are not immediate and are not asynchronous. Rather, the facilitator pulls forward comments made asynchronously to the synchronous session. The online facilitator may ask a

teacher to say more about their asynchronous post, including supporting their original post with additional evidence or seeking input from other teachers in the synchronous session.

To ensure that asynchronous sessions surface teachers' thinking about science and pedagogy, we crafted *crux questions* and embedded them in the asynchronous space. Crux questions were crucial to finding out what teachers understood and where challenges remained. Crux questions required revision over three pilot studies as we developed STeLLA Online.

- Sample science content crux question: What's in the bubbles when water boils?
- Sample pedagogy crux question: How are the three STeLLA strategies that are the focus of this week the same and *how are they different* from each other?

Developing Collaborative Community

Stair Stepping into Openness and Vulnerability

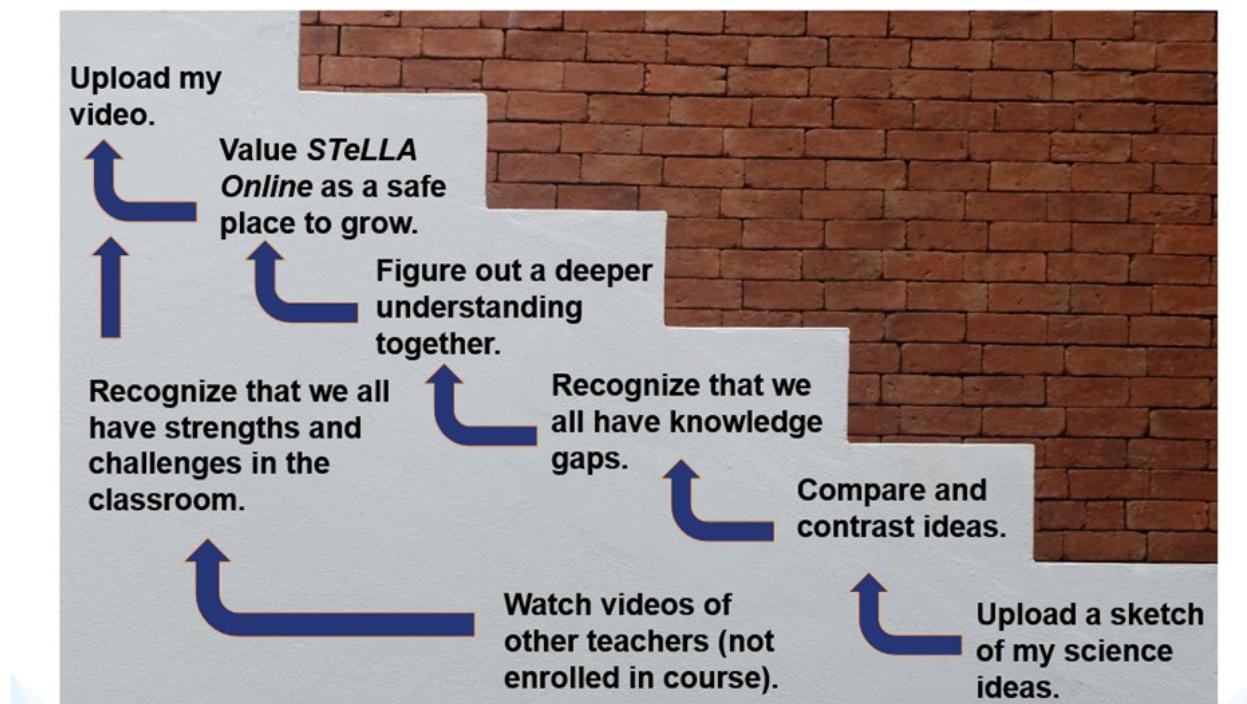


Figure 5. Slowly building trust in STeLLA Online

Figure 5 shows how the course is structured to incrementally increase the level of risk we ask participants to take over the span of the course. This slow increase over time helped build collaborative, trusting communities in an entirely online space.

We start down in the lower right corner, asking teachers to do something that takes a bit of risk - upload a sketch that shows their explanation of a science idea. This is hardest for teachers who feel like they are supposed to know the answers.

With video, we have teachers start by watching videos of other teachers who are not participating in the course. They develop the ability to critique video and get comfortable with the process.

We regularly ask teachers to compare and contrast ideas. This normalizes the notion that we all have different perspectives.

Once we begin to develop this understanding - we can start to dig deeper. STeLLA Online becomes a safe place to grow, and it is at that point that we finally ask teachers to upload their own video and analyze video of their peers. At this point they have demonstrated the ability to be open and vulnerable, but also the ability to really push on one another.

Developing Facilitators

Lead Facilitators and Co-Pilots

- Includes side-by-side learning
- Much more coaching in real time than is possible in face-to-face
- Tacit is made explicit

We use a mentorship model of leader development with facilitators-in-training acting as co-pilots. The people we selected as co-pilots had been through one or more STeLLA PL experiences as a learner. We invited them to study the module designs and gradually take on greater and greater leadership roles as the summer and fall progressed. By the end of the year, the co-pilots were ready to be lead facilitators in their own right.

This model is, in some ways, easier for new facilitators than the face-to-face leader development model. Co-pilots have a full year of working alongside an experienced facilitator, and handing over the reins is a more gradual process than it is when we mentor facilitators in face-to-face STeLLA.

Finally, in face-to-face STeLLA, facilitators make thousands of decisions on the spot based on what participants say in the moment. The thoughtful moves of an experienced STeLLA facilitator are often invisible to the casual observer and new facilitators alike.

For STeLLA online, so many of the facilitation moves are baked into module structures and crux questions that the tacit in face-to-face is more explicit online. While there are still split-second decision moments in the synchronous session, there is more time for lead facilitators and co-pilots to reflect, discuss and plan in advance of the synchronous session each week.



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Abstract

Objective Over the past decade, we developed and studied a face-to-face video-based analysis-of-practice PD model. In a cluster randomized trial, we found that the face-to-face model enhanced elementary science teacher knowledge and practice, and resulted in important improvements to student science achievement (student treatment effect, $d = 0.6$: Authors, 2017: Authors, 2019). The face-to-face PD model is expensive and difficult to scale. In this poster, we present the results of a two-year design-based research study to translate the face-to-face PD into a facilitated online PD experience. The purpose is to create an effective, flexible, and cost-efficient PD model that will reach a broader audience of teachers.

Perspective/Theoretical Framework The face-to-face PD model is grounded in situated cognition and cognitive apprenticeship frameworks. Teachers engage in learning science content and practices in the context in which they will be teaching. In addition, there are scaffolded opportunities for teachers to learn from model videos by experienced teachers, try model units, and ultimately develop their own unit, with guidance. The PD model also attends to the key features of effective PD as described by Desimone (2009) and others. We adhered closely to the design principles of the face-to-face model as described by Authors, 2019.

Methods We followed a design-based research approach (DBR: Cobb et al., 2003; Shavelson et al., 2003) to examine the online program components and how they promoted or interfered with the development of teachers' knowledge and reflective practice. Of central interest was the examination of mechanisms for facilitating teacher learning (Confrey, 2006). To accomplish this goal, design researchers engaged in iterative cycles of problem analysis, design, implementation, examination, and redesign (Wang & Hannafin, 2005). Data We iteratively designed, tested, and revised 17 modules across three pilot versions. Three small groups of teachers engaged in both synchronous and asynchronous components of the larger online course. They responded to surveys and took part in interviews related to the PD. The PD facilitators took extensive notes after each iteration. The development team met weekly to discuss revisions.

Results We found that community building required the same incremental trust-building activities that occur in face-to-face PD. Teachers began with low-risk activities and gradually engaged in activities that required greater vulnerability (sharing a video of themselves teaching a model unit for analysis and critique by the group). We also identified how to contextualize technical tools with instructional prompts to allow teachers to productively interact with one another about science ideas asynchronously. As part of that effort, we crafted crux questions to surface teachers' confusions or challenges related to content or pedagogy. Facilitators leveraged asynchronous responses to crux questions in the synchronous sessions to push teacher thinking further than would have otherwise been possible in a 2-hour synchronous video-conference. Significance Supporting teachers with effective, flexible, and cost-efficient PD is difficult under the best of circumstances. In the era of COVID-19, online PD has taken on new urgency. AERA members will gain insight into the construction of an online PD for elementary science teachers.

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