Bridging Geographic Distance

Technology-Mediated Lesson Study for Rural Science Teachers

August 2026

Rasha Elsayed, Cathy Ringstaff, Rebecca Sansom

This material is based on work supported by the National Science Foundation under Award Nos. DRL-2101383 and DRL-2450874. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. WestEd conducted a program evaluation from 2021 to 2026. Learn more about this work and view other profiles at https://www.wested.org/support/evaluation-services/.

Acknowledgments

We are grateful to the 3D-RST project team for their partnership throughout this evaluation. We thank the project leadership team: Heather Leary (Brigham Young University), Max Longhurst (Utah State University), Josh Stowers (Brigham Young University), and Laurel Harker, Project Manager. We also thank the project's research team: Michelle Hudson, Tracy Poulsen, and Clara Smith (Brigham Young University), Syahrul Amin (Texas A&M University), and Austin Moore (Utah State University).

We thank Andrew Grillo-Hill (WestEd) for his guidance and review throughout the development of this report.

Finally, we thank the rural science teachers who participated in the 3D-RST project. Their willingness to share their experiences and practice and contribute their expertise made this research possible.

Introduction

Technology-mediated lesson study (TMLS) is a teacher-led professional learning model in which small groups of teachers collaborate to design, teach, observe, and revise lessons together using classroom video observations, online meetings, and shared online workspaces to facilitate sustained, structured collaboration among rural science teachers. Developed as part of the Three-Dimensional Rural Science Teachers (3D-RST) project, which is funded by the National Science Foundation (DRL-2101383 and DRL-2450874), this project supports rural science teachers who often work as the only person in their setting who teaches their subject.

Rural communities in the United States are remarkably diverse, varying in remoteness; geography; and racial, ethnic, and socioeconomic composition. Each rural community carries a distinct history, culture, and social fabric (Lichter & Brown, 2011). Moreover, students' funds of knowledge, which describe the things rural children learn while interacting with their families and environment, can serve as springboards for instruction (Kassam & Avery, 2013; National Academies of Sciences, Engineering, and Medicine [NASEM], 2025). The teachers who work in these communities are part of that asset base and can make content more engaging for their students by focusing on place-based and local issues and by connecting with local organizations and resources that are less available to many urban teachers (Tytler & Symington, 2015). This can enable teachers to develop projects that are more complicated and that leverage the diverse aspects of each community (NASEM, 2025).

In this context, the local assets that rural teachers, students, and their communities bring can be leveraged through professional development that helps teachers recognize, utilize, and collaborate to uplift these assets. This brief describes TMLS as a professional learning model that supports rural teachers in addressing the geographic dispersion that can limit their collaboration and helps them improve their teaching without being limited by time and location.

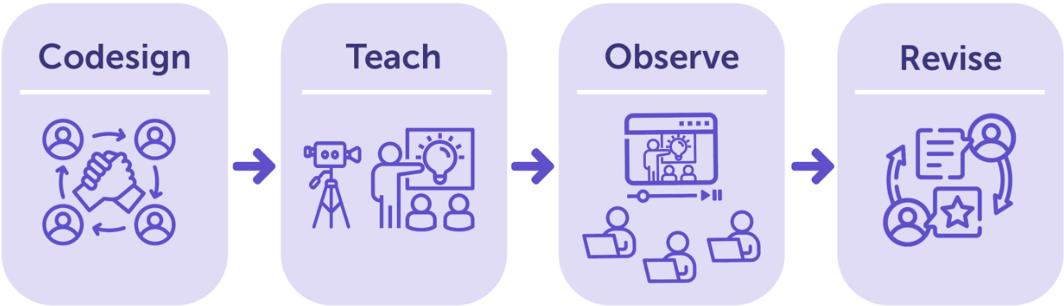
Technology-Mediated Lesson Study as a Professional Learning Model

> *"You go to a professional development meeting, and they tell you what you're going to do, and then you don't get the time to practice it. So you fall back into the same rhythm that you were [in] before, whereas the [TMLS] model has [given us] time to practice it. And then when it wasn't right, we had time to fix it. And then we had more time to fix it until [the lesson] was where we were happy."* —TMLS teacher

TMLS is an adaptation of traditional lesson study (Lewis & Hurd, 2011) in which teachers collaborate on designing, teaching, observing, and iterating on lessons. They complete this process while using technology so that they do not need to be together physically.

TMLS follows the same cycle as lesson study: A group of teachers codesign a lesson, each teacher teaches it, others observe and give feedback, the team meets to revise and reteach, and the group's interactions and observations are mediated through digital tools (Leary et al., 2025; Figure 1). What makes TMLS unique is that it is a professional learning model that is co-facilitated by teachers themselves rather than by experts or researchers

Figure 1. The TMLS Process



TMLS is facilitated by teachers in a group led by a science teacher leader (STL) who is experienced in TMLS. STLs offer logistical coordination, emotional intelligence, and pedagogical insights as they facilitate meetings, communicate with team members, and use various tools and strategies to support the lesson study process. Although TMLS is led by teachers for teachers, content experts and professional learning specialists play an important role in anchoring learning with the content and pedagogical knowledge that support the goals identified by teachers for the TMLS process.

In What Ways Does TMLS Support Rural Science Teachers?

TMLS Deepens Teachers' Knowledge of Science Teaching

The 3D-RST project focused on three-dimensional (3D) science instruction, which integrates science and engineering practices, crosscutting concepts, and disciplinary core ideas. Teachers entered the project with varying levels of familiarity with these dimensions, and they built their understanding through repeated TMLS cycles that were anchored with in-person workshops facilitated by content experts in 3D science instruction. The TMLS process allowed teachers to observe their own teaching alongside their colleagues who were teaching the same lesson. This process surfaced practices that teachers might otherwise have missed, and the sustained focus on a single lesson made the three dimensions of science instruction more concrete and usable in their planning (Hudson et al., 2024). The extended collaboration also helped teachers develop and practice new pedagogical and content knowledge, and it gave them confidence to engage in instructional innovation.

> *"Sincerely, I have experienced growth and improvement that I would explain as being monumental. Many of us have shared that this experience has been the best professional development we have ever been a part of. I will never, ever forget what I experienced in my own classroom and what I observed in other*

team members' classrooms when students would walk into class and see the camera set up for a recording. I personally had students in my class—and heard students in other classes on video—express their excitement for class because they had now been trained that when the camera was out, they were in for a great lesson. And great lessons they were. More importantly, though, my daily lessons have gradually changed to mirror the work I performed in the project. My classroom has been transformed. I believe that others interested in participating in TMLS in any discipline will experience the same transformation." —TMLS participant

TMLS Builds Professional Networks for Teachers Across Geographical Boundaries

Rural science teachers often experience professional isolation. Within their own schools, many are the only teachers of their subject or grade level. Beyond the school, ties to other science teachers are sparse. TMLS can bring isolated rural science teachers an opportunity to work with colleagues who teach the same content and to work with them through the same lessons over the school year. The small-team structure of the TMLS groups helps build trust, enabling teachers to provide critical feedback and offer ongoing peer support. Across the years of the project, the 3D-RST team found that TMLS helped teachers form durable professional networks over the course of the collaboration that otherwise they would not have made. TMLS also enabled peer mentoring and ongoing informal support (Amin et al., 2026; Hudson et al., 2024; Poulsen et al., 2024). These teacher connections benefit both students and teachers in that they facilitate more engagement and participation with STEM activities.

"Multiple times a week, there was some form of contact between us. ... It [helped create] a network that I felt good reaching out to: I didn't have to wait until the meeting. ... I could reach out to the group at any time, and that has helped even beyond the lessons."
—TMLS participant

"Your team doesn't have to be in your building. ... You can create something great and support each other, [and] it's okay that it's not the teacher in the room next to you." —TMLS participant

"I've talked more with [this group] through this past year about instruction than I've probably [done] with anyone in the past eighteen years."
—TMLS participant

"Because I'm at a school where I'm the only science teacher, ... it's the first time I've been recorded and had people ... who have to teach the same content [look at my teaching]."
—TMLS participant

TMLS Promotes Local Leadership Capacity

TMLS is structurally designed to be led by STLs who are not external experts or researchers but rather colleagues and practicing teachers who mentor their peers through the TMLS cycle of collaborative inquiry. This design makes TMLS accessible to teachers everywhere. STLs facilitate meetings, communicate and encourage their team, build relationships, and model reflective practice (Leary et al., 2025). With readily available facilitation tools, TMLS is designed to build a productive and relational collaboration based on mutual respect and shared experiences.

"My responsibility [as the leader] was to help the other teachers understand the lesson study process and the lesson standards in such a way that their confidence grows in designing lessons for their classrooms. Secondarily, I also helped them develop into leaders themselves so that they could lead future teams or colleagues in projects and at their schools." —TMLS teacher leader

Teachers who serve as STLs report growth in their confidence in their own teaching of 3D science and in their ability to lead other teachers.

> *"The experience of being a science teacher leader during this TMLS process has made all the difference in my confidence in teaching three-dimensional science and in my leadership ability with other teachers."*
> —TMLS teacher leader

Teacher Spotlight: Thomas Wilder, Sevier County School District

Thomas joined the 3D-RST project as a teacher participant in the first cohort. He then moved into an STL role for 2 years before joining the sustainability team, which worked to establish ongoing strategies for communication and support after the end of the grant. Thomas teaches both social studies and science in an NCES-classified (remote town/remote rural) high school. He had previously been a department chair in social studies, but his participation in 3D-RST allowed him to extend his leadership to science as well. He now leads the districtwide professional development for science teachers once per year, attended by teachers from the district's eight secondary schools. In the professional development sessions, he shares 3D science resources such as the lesson plans from the 3D-RST project, and he helps teachers build competence with the science and engineering practices and the crosscutting concepts. He also leads the districtwide effort to integrate 3D science teaching, with a move toward standards-based grading. Through his work on the sustainability team, Thomas concluded that because superintendents must attend to many demands beyond instruction, teachers who want to advance instructional priorities need to lead those efforts themselves.

TMLS Connects Teachers Through One Another's Expertise

Rural science teachers bring knowledge of local environments, industries, and community contexts that rarely surface in conventional professional development, but that knowledge often stays confined to a single classroom. The 3D-RST project found that these teachers bring instructional expertise that goes unshared because of the professional isolation they experience. Excellent teaching is happening in these spaces, but the prevailing deficit view of rural schools tends to obscure it. TMLS remedies this situation by connecting teachers across school and district boundaries with colleagues who have varying levels of expertise, teach the same content, face similar challenges, and form synergistic relationships that elevate one another's strengths through the TMLS process. As one TMLS participant describes,

> *"I would say watching others teaching also builds relationships, because you can recognize that teacher's brilliance to a level that you don't see in your one-on-one interactions with them. You see them in their element—in their room, teaching a lesson, interacting with their students—and you can see the magic that they create as a teacher. I think that always builds a lot of respect for them, if I can see them teach.*
>
> *[Another teacher and I] became dear friends, and I admire the type of teacher she is. She has such a kind heart. She has extensive knowledge. She has great classroom management. She has great strategies for interacting with students and helping students feel at ease and accepted in her room. ... She comes at teaching from a different perspective sometimes, and we have a lot of different opinions about things. But she is just somebody I really look up to as a person and as a teacher. I've learned a lot by watching videos of her teaching the lessons we created—watching the way she delivers, the way she interacts with students, the way she structures things. I feel like that's teacher goals for me. Someday I might be as cool as [she is]."* —TMLS participant

Figure 2. Steps of the TMLS Process

Note. Adapted from Amin et al. (2026).

Getting Started With TMLS

This section provides an overview of the five steps of the TMLS process (Figure 2). For more details on implementing this process, please refer to the article titled Technology-Mediated Lesson Study: A Step-by-Step Guide (Hudson et al., 2024).

Step 1: Gather a Group

- Gather a group of teachers of the same subject area or grade band who are interested in improving their teaching practice and can commit to this collaboration for an extended period of time (approximately 9 months). Teachers need not be within the same geographical area.
- Identify a group leader from within the group. This group leader supports the facilitation of the group and participates equally in all the TMLS activities. This is how one group leader described their role:

> *"I help the group stay on task, help the meetings be more organized, try to help the group think more deeply about topics, and help the group come to consensus."* —TMLS teacher leader

- Establish the goals of the group (e.g., shift toward 3D science teaching, develop biology lessons for grade 7). Groups without existing expertise in the target content or practices may need outside input through a facilitator, subject-matter expert, or structured self-study to move from a general interest to a focused, actionable goal.

> **Tips**
>
> - Note that regional centers or universities in rural areas may be able to play a role in identifying and convening teachers.
> - Aim for three to five teachers who teach the same or similar content.

A crucial component of TMLS is beginning the process within a carefully designed in-person workshop with content experts to support the development of teachers' content and pedagogical knowledge. Although this is sometimes difficult logistically, giving teachers the opportunity to collaborate in person has been shown to build camaraderie and trust, which is necessary for the successful implementation of TMLS. In addition, feedback needs to be provided to teachers in the workshop during the design process so that teachers are encouraged to clarify their goals as they work on their TMLS lesson.

Step 2: Develop a Lesson

- Choose an existing lesson or develop a new lesson based on the standard or topic area on which teachers agree to focus. This lesson will be the central focus of the TMLS process.
- Hold lesson creation meetings in a virtual setting or during an in-person workshop, and provide technology training during the meetings if needed.
- Schedule short microteaching practice sessions with other teachers before classroom teaching.

Tips

- Create a lesson plan template that teachers can follow.
- Ensure that teachers have access to a shared folder that contains all the lessons and recordings.

Step 3: Teach and Record

- Begin the cycle of teaching, feedback, and iteration. One team member agrees to teach the lesson as written and records themselves and their students as they teach the lesson. The teacher also collects artifacts such as exit tickets and work samples.
- Upload the teaching videos, artifacts, and short notes on the context in which they taught the lesson.
- Identify technologies that can facilitate online collaboration, storage, and video recording of lesson implementation. The 3D-RST project utilized Swivl cameras and the Reflectivity platform, a secure professional development and self-reflection platform designed for educators.

Step 4: Watch and Comment

- Watch the video and leave time-stamped evidence-based comments (all teachers, including the recorded teacher).
- Focus the observation comments on lesson implementation, student learning, and shared goals set by the group and delineated by a rubric.

Tip

- Emphasize the importance of having teachers do their reviews promptly and fully because timely, thoughtful feedback affects the experience for all teachers.

Step 5: Reflect

- Meet in person or online to share feedback on the process and the products (i.e., lesson plan and supporting materials) and plan for changes in the next cycle.

Cost of TMLS

Item	Approximate cost	Notes for planning
Swivl camera (optional)	~$1,500 one time per teacher or shared team	• A single camera can be shipped among team members, lowering per teacher cost. This is not required if teams have another reliable way to record classroom video.
Swivl Reflectivity license	Approximately $100 per teacher per year	• This provides a secure space to upload classroom videos where teachers can add time-stamped comments and use rubrics to give feedback. Because videos are accessible only to participants and are not stored locally, recordings can be shared across district boundaries.
Videoconferencing such as Zoom, Teams, or Google Meet	Typically covered by an existing license	• This technology is used for synchronous group meetings. Most districts already have a suitable license.
Teacher stipends	Approximately $35 per teacher per hour for work beyond teachers' contract time	• This is the main recurring personnel cost.
Meeting coordination	Varies by the available existing administrative capacity	• n/a
In-person workshops	Varies with number and length of workshops	• In-person workshops build connections among teachers and strengthen content knowledge as they bring together relevant content experts. They can be held before each TMLS cycle and typically run 2–4 days. • When possible, support teacher attendance with substitute coverage and reimbursement for lodging and travel. • Workshops are most effective in person, but virtual workshops can substitute when in-person meeting is not feasible. The cost depends on the number of workshops, their length, and travel distances.

Lessons Learned About What Makes TMLS Work

Over the course of the 3D-RST project, the team identified several factors that make TMLS work in practice.

Design and Group Dynamics

- TMLS works because it is authentic and relevant to teachers' needs. Teachers chose problems and designed lessons that were relevant to them, and that increased their motivation to continue learning.

> *"We intentionally designed this so that we are doing something in the professional learning … that they need already."* —Co–project investigator

- The TMLS structure treated teachers as professionals with expertise, and that gave them ownership and agency.
- Being flexible and responsive to teachers' needs is key to TMLS's success.
- The shared workload through the TMLS process allows teachers to collectively accomplish much more than they could on their own. This shared workload allowed teachers to engage in deep, iterative lesson development.

> *"This lesson is something that I've taught over the years, and this year—because of the work that we're doing together—it's by far a much better lesson, and the students have a much better experience than they've ever had in the past with me."* —TMLS participant

Institutional Supports That Can Promote Participation

- Sending annual letters that praise teachers, share dates, and cover substitute costs can cultivate administrators' buy-in.
- Stipends, structured meetings, and the immediate impact teachers see on their practice and students' engagement incentivize sustained participation.

- Participation in TMLS can count as a university course, so teachers can earn credit and could be accepted by states as meeting requirements for an alternative route for licensure.

Implications and Next Steps

TMLS creates a space for self-sustained, structured collaboration among rural science teachers. Teachers are overwhelmingly positive about the impact of the program on their confidence and on their teaching practice, their ability to expand their professional network beyond their own school sites and districts, and the opportunity to expand their capacity to lead other teachers. These impacts on teachers are benefiting students and teachers as they become more engaged and participatory in STEM activities.

To learn more about starting a TMLS for your area, visit the 3D-RST website, see Technology-Mediated Lesson Study: A Practical Guide for Educators (Leary et al., 2025), or contact Project Director Rebecca Sansom at rebecca.sansom@tamu.edu.

References

Amin, S., Sansom, R. L., & Poulsen, T. (2026). Professional development and rural science teachers' expanding social networks: A longitudinal analysis. *Professional Development in Education*, 1–26. https://doi.org/10.1080/19415257.2026.2650714

Hudson, M., Leary, H., Longhurst, M., Stowers, J., Poulsen, T., Smith, C., & Sansom, R. L. (2024). Technology-mediated lesson study: A step-by-step guide. *International Journal for Lesson and Learning Studies*, *13*(5), 1–14. https://doi.org/10.1108/IJLLS-07-2023-0094

Kassam, K. S., & Avery, L. (2013). The *Oikos* of rural children: A lesson for the adults in experiential education. *Journal of Sustainability Education*, *5.* https://www.susted.com/wordpress/content/the-oikos-of-rural-children-a-lesson-for-the-adults-in-experiential-education_2013_05/

Leary, H., Hudson, M., Longhurst, M., Stowers, J., Morris, D., & Sansom, R. (2025). *Technology-mediated lesson study: A practical guide for educators.* EdTech Books. https://edtechbooks.org/technology_mediated_lesson_study

Lewis, C. C., & Hurd, J. (2011). *Lesson study step by step: How teacher learning communities improve instruction*. Heinemann.

Lichter, D. T., & Brown, D. L. (2011). Rural America in an urban society: Changing spatial and social boundaries. *Annual Review of Sociology*, *37*, 565–592. https://www.annualreviews.org/content/journals/10.1146/annurev-soc-081309-150208

National Academies of Sciences, Engineering, and Medicine. (2025). *K-12 STEM education and workforce development in rural areas*. The National Academies Press.

Poulsen, T., Leary, H., Daly, A., & Sansom, R. (2024). Uncovering the connections among rural science teachers: A social network analysis. *AERA Open*, *10*. https://doi.org/10.1177/23328584241253821

Tytler, R., & Symington, D. (2015). Science learning in rural Australia: Not necessarily the poor cousin. *Teaching Science*, *61*(3), 19–25.

Suggested citation: Elsayed, R., Ringstaff, C., & Sansom, R. (2026) *Bridging geographic distance: Technology-mediated lesson study for rural science teachers*. WestEd.

This material is based on work supported by the National Science Foundation under Award Nos. DRL-2101383 and DRL-2450874. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. WestEd conducted a program evaluation from 2021 to 2026.

Learn more about this work and view other profiles at https://www.wested.org/support/evaluation-services/.

WestEd is a nonpartisan, nonprofit organization that aims to improve the lives of children and adults at all ages of learning and development. We do this by addressing challenges in education and human development, increasing opportunity, and helping build communities where all can thrive. WestEd staff conduct and apply research, provide technical assistance, and support professional learning. We work with early learning educators, classroom teachers, local and state leaders, and policymakers at all levels of government.

For more information, visit WestEd.org. For regular updates on research, free resources, solutions, and job postings from WestEd, subscribe to the *E-Bulletin*, our semimonthly e-newsletter, at WestEd.org/subscribe.

This publication has been designed using resources from Flaticon.com