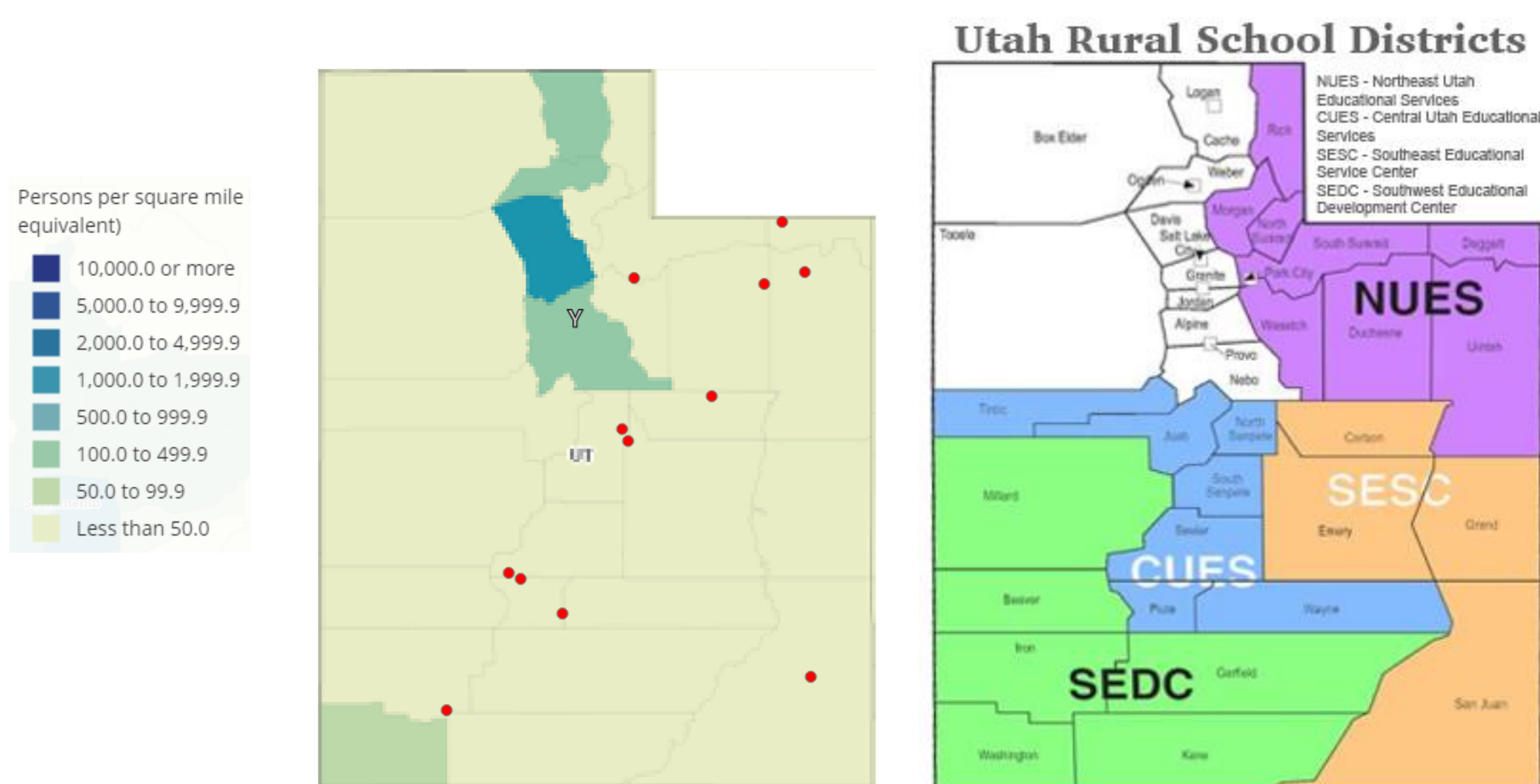


Developing the Pedagogical Skills and Science Expertise of Teachers in Underserved Rural Settings

Max Longhurst, Rebecca Sansom, Heather Leary, & Josh Stowers



RURAL EDUCATION IN UTAH

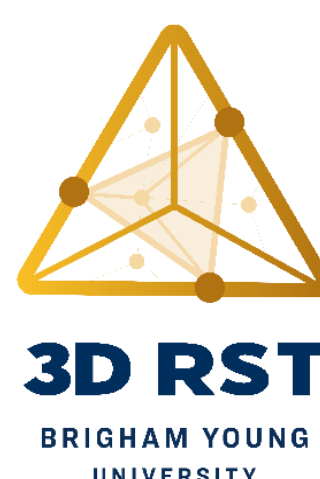


Rural Professional Development

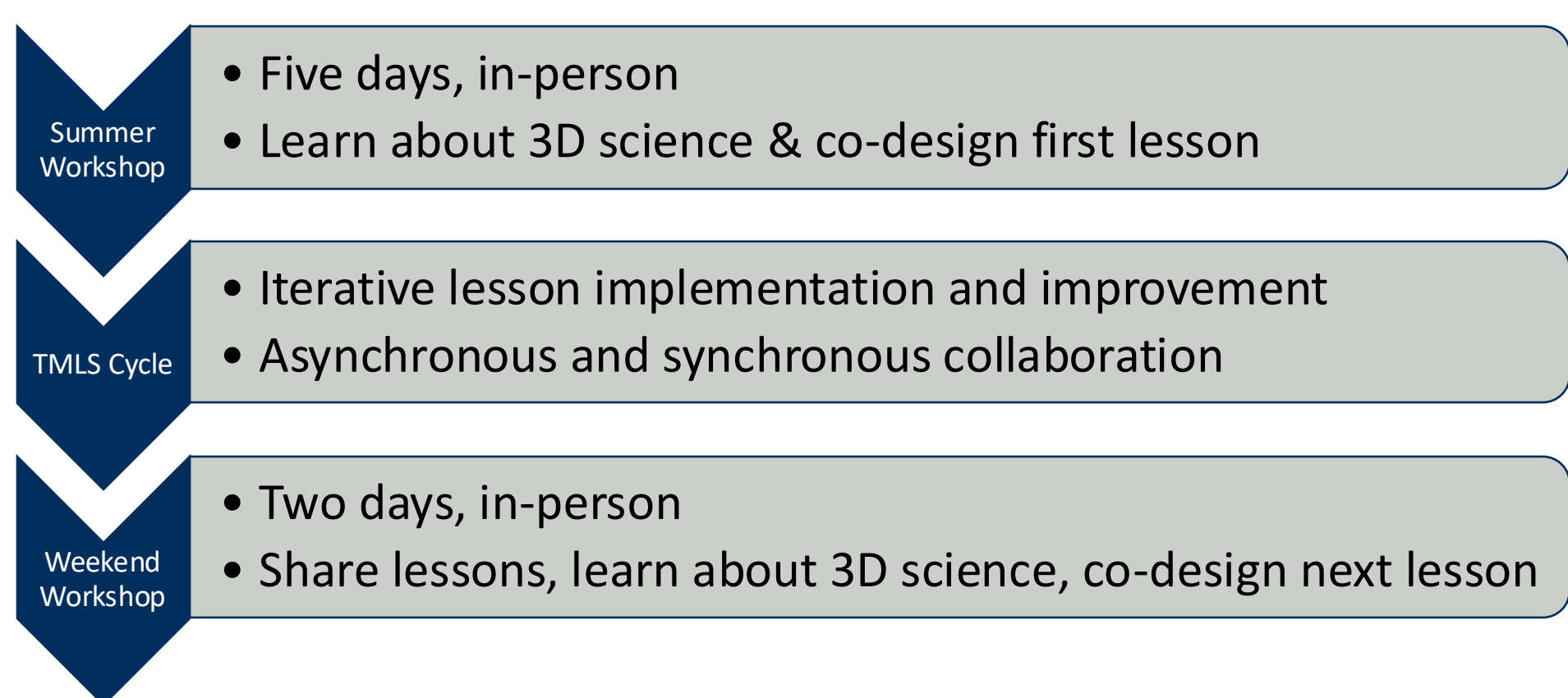
- Effective professional development should be ongoing, collaborative, and practice-based
- Rural teachers struggle with this:
 - The only teacher in their field (e.g., physical science) or subject (e.g., biology) in their school
 - Geographical distance from other educators teaching the same subjects
 - Additional responsibilities (such as coaching, administrative work, etc.)
 - Reduced access to PD opportunities

PROFESSIONAL LEARNING PROGRAM STRUCTURE

- Effective professional development should be ongoing, collaborative, and practice-based
- Rural teachers struggle with this:
 - The only teacher in their field (e.g., physical science) or subject (e.g., biology) in their school/district
 - Geographical distance from other educators teaching the same subjects
 - Additional responsibilities (such as coaching, administrative work, etc.)
 - Reduced access to professional development opportunities
- TMLS is designed to address these issues



Year	Cohort	Science Teacher Leaders	Teacher Participants	Total Participants
1: 2021-2022	Pilot	4	0	4
2: 2022-2023	First	3	9	12
3: 2023-2024	Second	6	19	25
4: 2024-2025	Third	8	21	29



EMPOWERING TEACHER LEADERS



- One of the 3DRST project's main goals is to build teachers' expertise and capacity.
- Each TMLS group is led by a teacher leader who facilitates the TMLS process and mentors the other teachers. The research team steps back and lets the teachers lead.

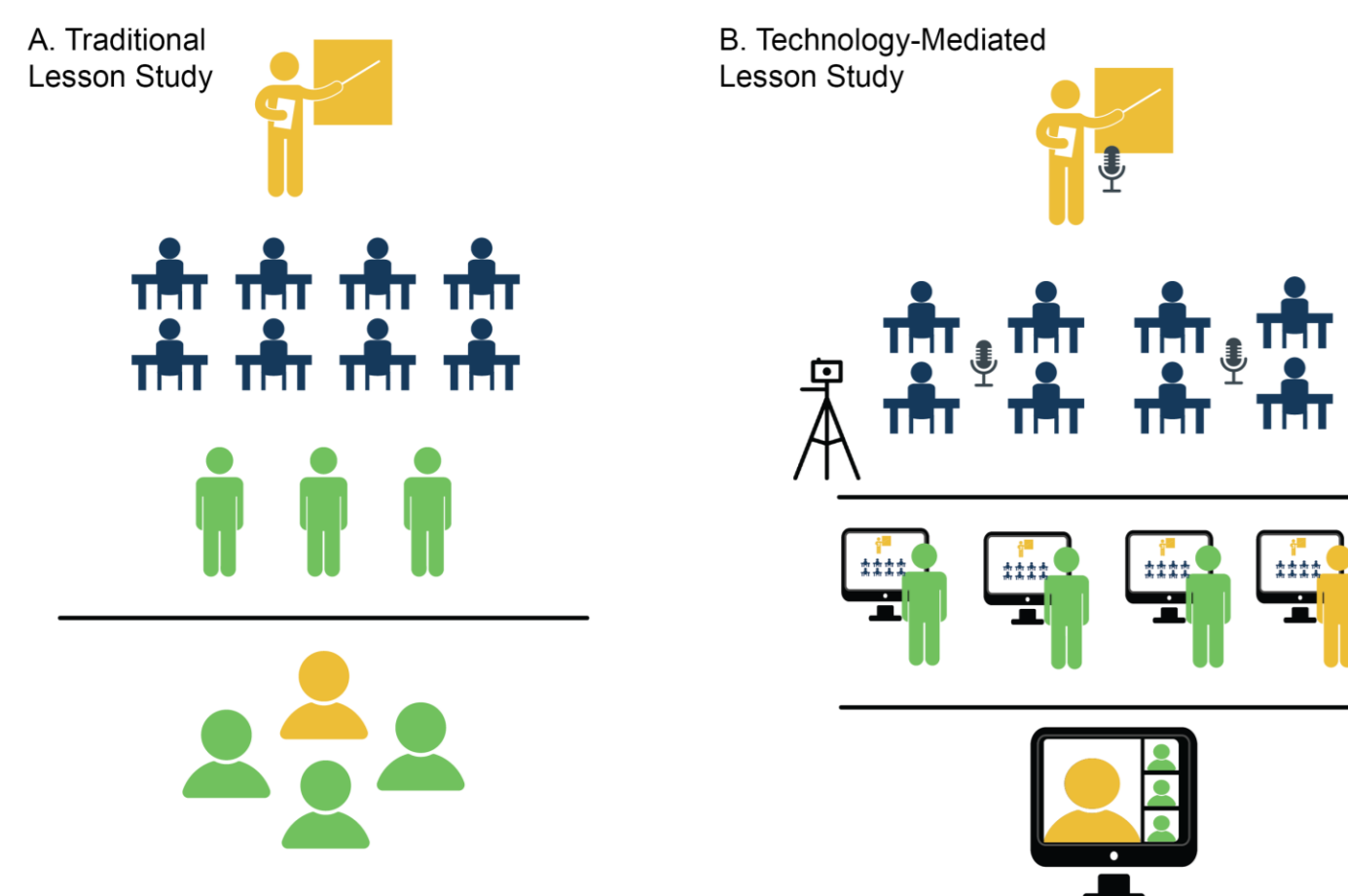
"The group I've worked with here, I've probably talked with more through this past year about instruction than I've probably had with anyone in the past eighteen years."

ACKNOWLEDGEMENT

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TECHNOLOGY-MEDIATED LESSON STUDY (TMLS)

- Lesson study involves a group of educators coming together with shared goals for student learning and co-creating lessons to meet those goals. Teachers watch each other teach the lesson to students in the classroom.
- TMLS is a new variation of lesson study that uses technology to connect isolated educators to co-create and refine lessons by allowing teachers to watch classroom interactions virtually.
- TMLS is designed to be self-perpetuating and can be adopted by any interested teachers.



TMLS: A STEP-BY-STEP GUIDE

STEP 1: GATHER A GROUP



STEP 2: IDENTIFY TMLS FOCUS: ESTABLISH SHARED GOALS

For the 3DRST project, the group's goal is to develop and increase 3D science teaching skills. However, TMLS can be adapted to any group of educators with a shared teaching goal.

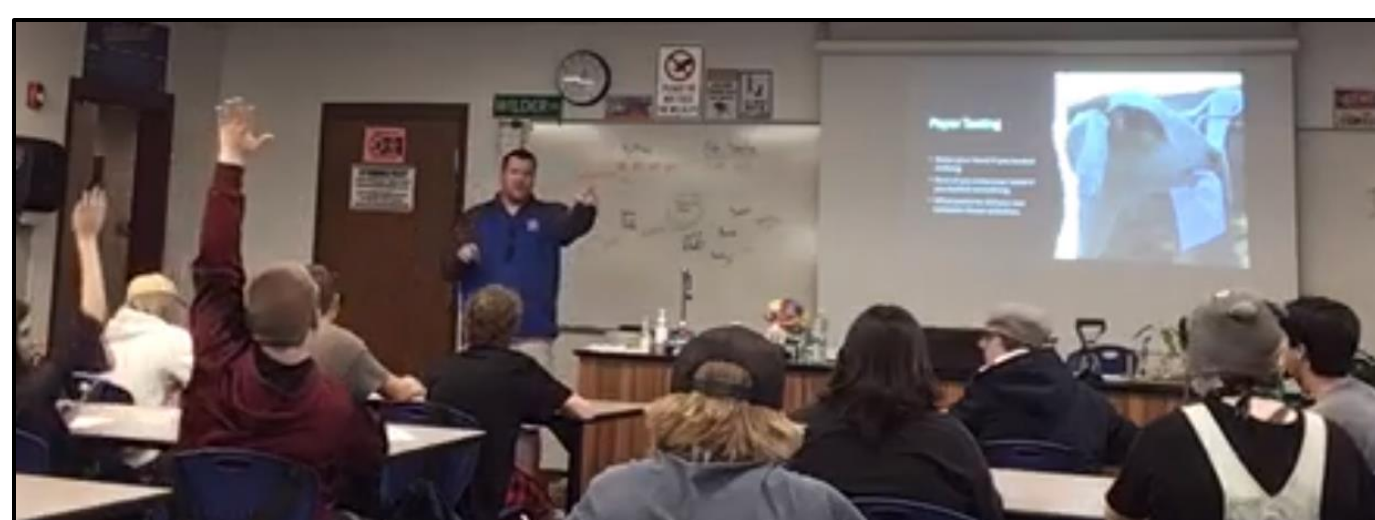


STEP 3: LESSON DEVELOPMENT

Microteaching the lesson to other teachers is a great way to evaluate lesson development before teaching it to students.



STEP 4: TEACH, RECORD, WATCH, & RESPOND



Swirl robots capture the lesson. Team members watch the video asynchronously and evaluate student learning.

Swirl Comments

Ronan: That is a cool way to connect that!

Rich: This was something I added to the worksheet. Look at the worksheet and we can discuss what should stay and go.

Ronan: I like how they put their data on the board as they come in. Much more organized than when I did it.

Lexi: It seems like the data collection with the going to the other classes went smoothly.

STEP 5: MEET TO DISCUSS & REVISE THE LESSON

Transcript from a TMLS Meeting

Ellen: I think adding a slide that says, 'this is what it is, and this is what it isn't.' What do you guys think?

Charles: I think more clarity is always better.

Brock: That's the teaching battle we have, right? Our desire to make sure that students understand versus trying to help them learn to figure out some of the things as they go.

Ellen: In my experience, when I spell it out for them, they forget, and they are more likely to remember if they have to figure it out.

Meganne: The slide show, as we have it, doesn't have a list, but we can have the students generate a list, maybe as a check for understanding.

Brock: Right. Because their ideas are creating the definitions. I think this slide is a good idea because it...

Ellen: ...forces them to be part of the lesson.

STEP 6: REPEAT STEPS 4 & 5 UNTIL ALL HAVE TAUGHT THE LESSON

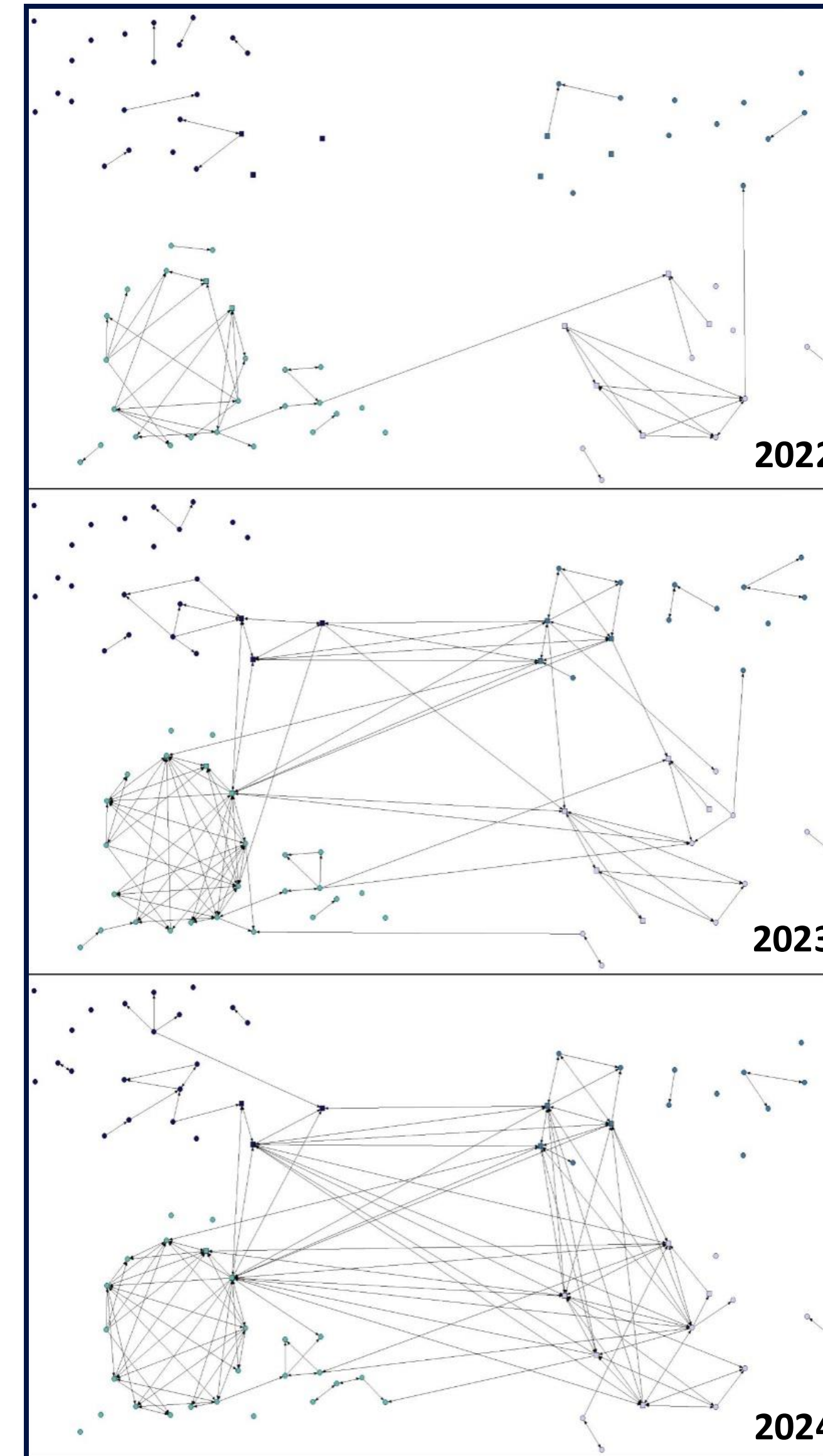
"If it were just up to me, I would teach a lesson, and I know I would have all kinds of ideas of what I could do differently, but I wouldn't go back and change it. But having some accountability, knowing that other people are going to teach the lesson, makes it better."

— TMLS participant

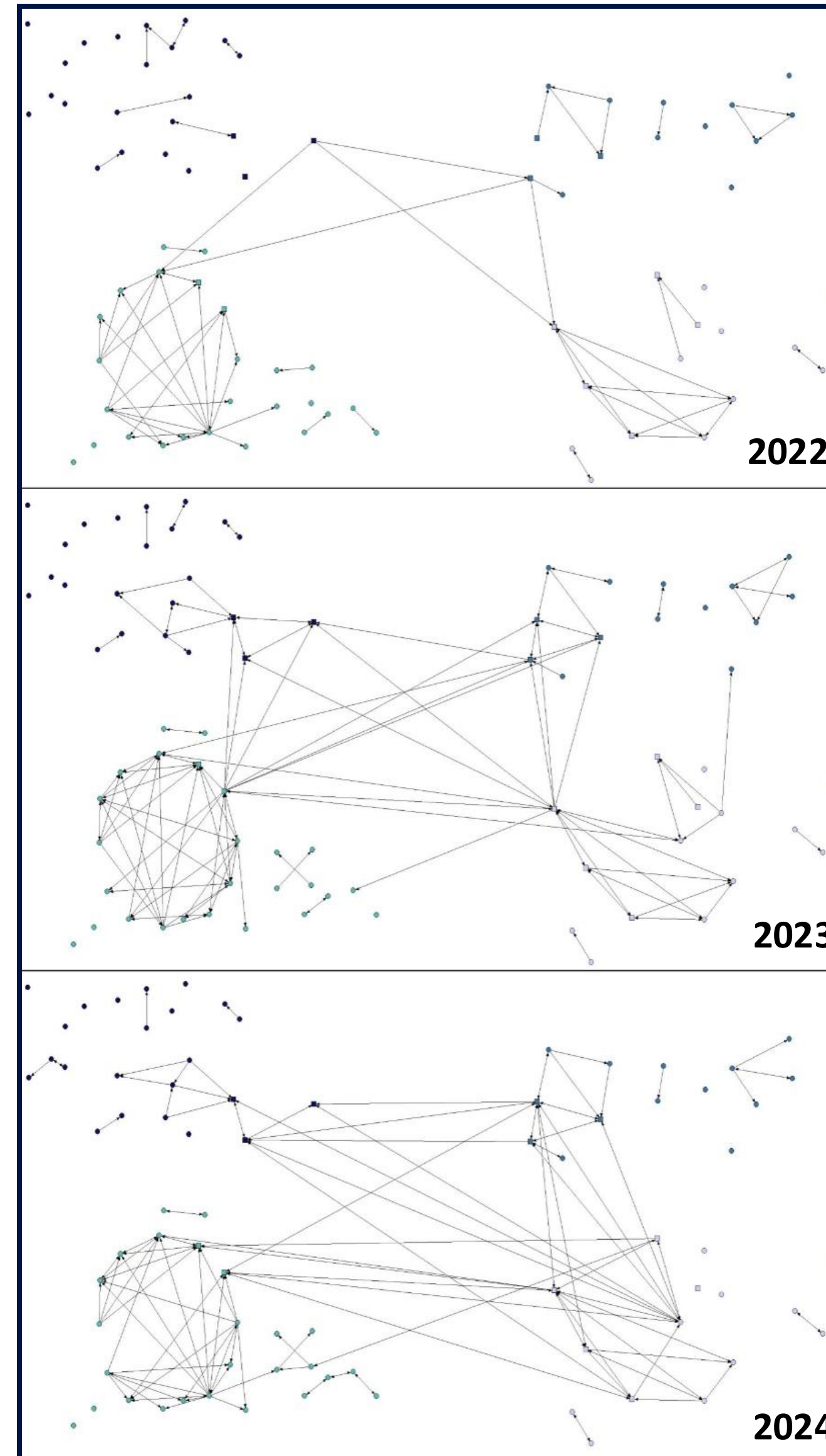
STEP 7: REFLECTION & POSSIBLE BEGINNING OF NEW TMLS CYCLE

SOCIAL NETWORK ANALYSIS OF RURAL UTAH SCIENCE TEACHERS

WHO DO YOU GO TO FOR ADVICE?



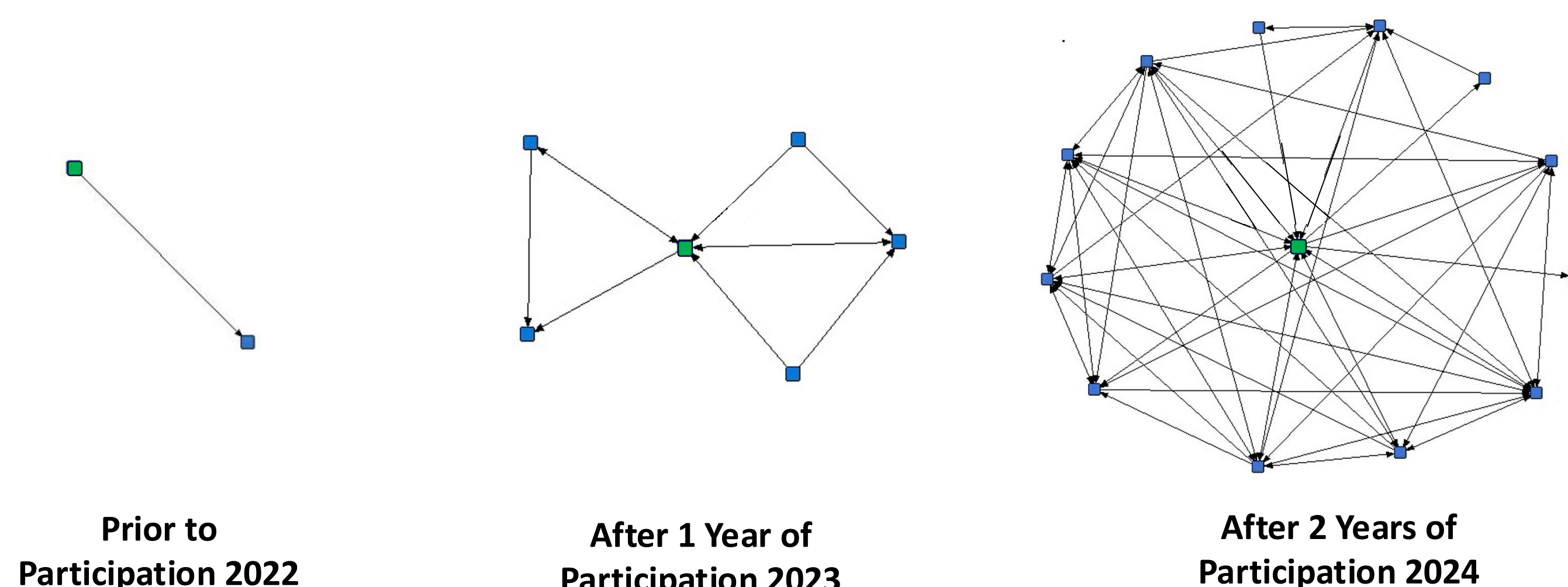
WHO ARE YOUR COLLABORATORS?



"The people I've met through this program will hopefully become my forever friends. They have helped me in my teaching already and have advised in many instances. I don't have a science department and these people are now my 'department.'"

INDIVIDUAL ADVICE NETWORK EVOLUTION

The individual network graphics below represent a single teacher in a rural space who participated in the TMLS project over the course of 3 years. The change represents one teacher and exemplifies the growth over time that we have observed in the project.



CONCLUSIONS

- TMLS assists rural science teachers in developing new connections, which strengthen over time.
- The professional development process of TMLS allows teachers the time to practice and develop knowledge and skills that extend beyond the lessons created in this project
- Teachers improve their 3D science teaching skills by writing lesson plans, teaching the lesson one at a time, watching each other teach it, and revising the lesson as a group.

OUR WORK

Hudson, M., Leary, H., Longhurst, M., Stowers, J., Poulsen, T., Smith, C., & Sansom, R. (2024). Technology-mediated lesson study: A step-by-step guide. *International Journal of Lesson and Learning Studies*, 13(5), 1-14.

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

Smith, C. M., Leary, H. M., Jensen, J. L., & Sansom, R. L. (2024). Ten Years of Three-Dimensional Science and Its Implementation in the Secondary Classroom: A Scoping Review. *Journal of Science Teacher Education*, 1-19.