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Overview

The **Model-Based Educational Resource (MBER)** is a year-long high school biology program designed to provide students opportunities to engage in modeling to generate scientific understanding. The curriculum is built around a clear storyline with explicit connections between biological ideas and provides teachers with pedagogical supports that outline how to engage students in the intellectual work of the classroom. An instructional framework highlights the connections between the three main components of any modeling lesson: the phenomenon, the question about the phenomenon, and the model that explains the phenomenon.

A quasi-experimental study was conducted in California with assignment at the teacher level. Treatment teachers used regular or living Earth versions of MBER curriculum and comparison teachers taught using their business-as-usual materials. Part of the study included observations of teachers in both conditions. We report here on the development and use of the observation tool.

Context and Constraints

Observations were conducted in Spring 2022. Our observation protocol had to overcome several constraints:

- **Geography:** Classrooms located across the state of CA
- **District Research Conditions:** many would not allow video
- **Pacing:** Teachers at widely differing places in the curriculum
- **Number of observers:** Norming across 7 observers
- **Range in sample:** Need to capture instructional practice spanning traditional pedagogy through high-fidelity MBER.

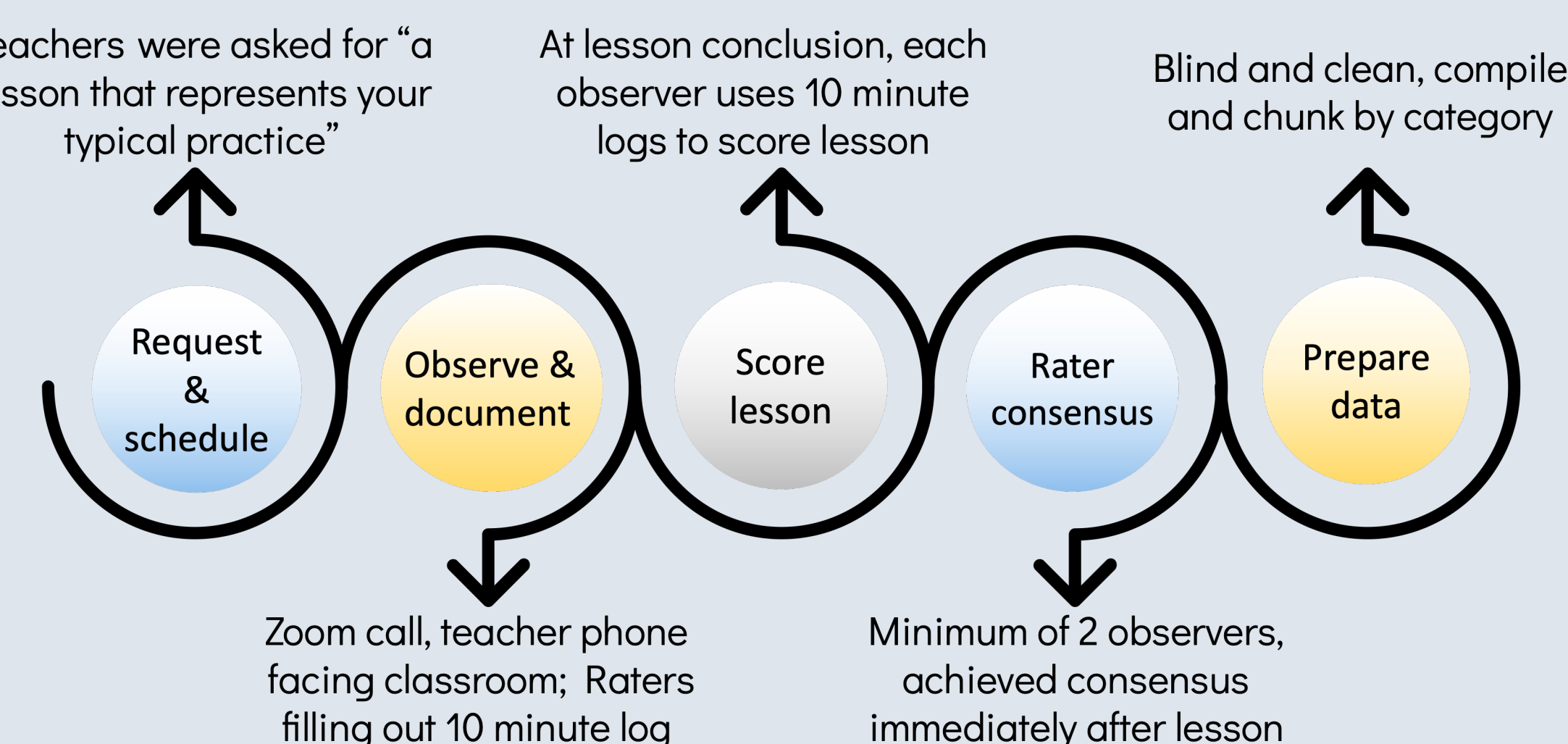
Our solution was to develop a protocol that could be carried out live and remotely, using Zoom calls, on lessons that differed in terms of content and structure. Remote access limited us to observations focused on the teacher because of poor audio for students.

Development

We began by identifying theoretical constructs that could be observed given the constraints and that corresponded with intended differences between MBER and typical science instruction (BaU). In the end, our tool examines the following 5 constructs. Scorers observed the lesson using a 10 minute logging format then immediately scored the lesson by responding to a series of questions identified here under each construct.

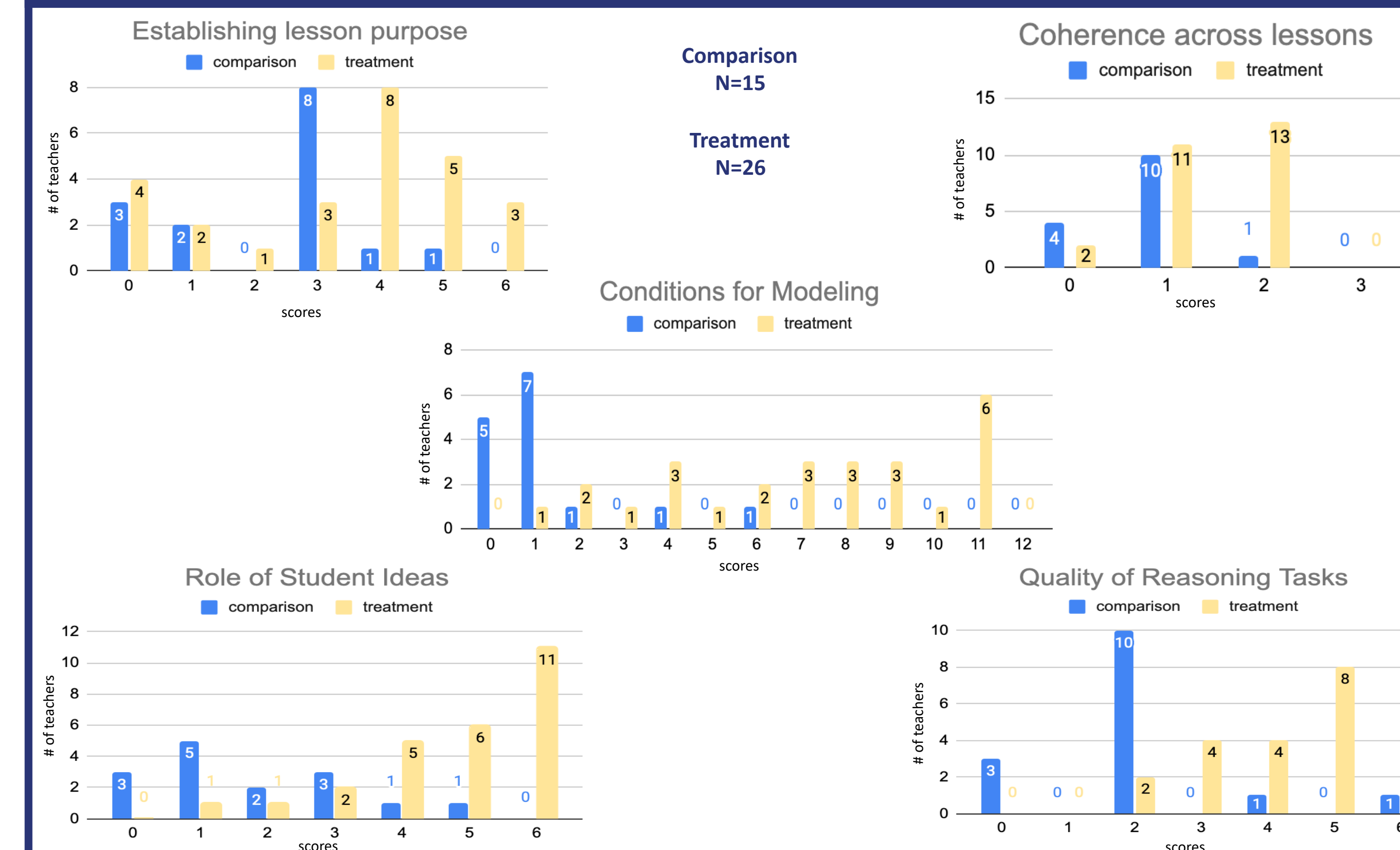
ESTABLISHING LESSON PURPOSE (scored 0-6)
<ul style="list-style-type: none"> • Was a clear purpose for the class session articulated by the teacher at any point? • Was the purpose only mentioned once or was purpose talk woven throughout the lesson? • Did the teacher engage students in the purpose by asking them questions about it or pressing them to explain the purpose of what they were doing?
ATTENDING TO CROSS-LESSON COHERENCE (scored 0-3)
<ul style="list-style-type: none"> • Was there evidence during this class session that ideas are being built over time (multiple days)? (Evidence may be in artifacts) • If yes, did the teacher explicitly reference this ongoing work?
ROLE OF STUDENT IDEAS (scored 0-6)
<ul style="list-style-type: none"> • In the class session today the teacher ELICITED student ideas. • Did the ideas elicited from students go beyond single word answers and/or rote questions? • Did the teacher ATTEND to student ideas today OR create the conditions for the students to attend to each other's ideas?
QUALITY OF REASONING TASKS (scored 0-7)
<ul style="list-style-type: none"> • Students were asked, in the tasks and/or by the teacher, to engage in any REASONING tasks today such as looking for patterns, making predictions, analyzing, designing an investigation or representation, making inferences, applying a model, explaining why something happens, etc.? • Were the reasoning tasks in service of a larger knowledge building endeavor? • When/if there was any reasoning happening in class today, WHO was doing the reasoning (teacher, students, mixed)?
CONDITIONS FOR MODELING (scored 0-12)
<ul style="list-style-type: none"> • Did the teacher describe the purpose of the lesson as connected to a phenomenon and/or question? • Was there a clear question/phenomenon/model guiding the ongoing work? • Did student input/ideas influence the intellectual direction or knowledge building work of the class today? • Today the class made (explicit or implicit) progress on an overall explanatory model that was clearly connected to a phenomenon. OR they used a model to make sense of something.

Process



Seven observers trained and normed on at set of 8 lessons in Feb-Mar of 2022. From March to early June the group observed a total of 41 lessons, 15 comparison and 26 MBER. All lessons had at least 2 observers, including one of the senior researchers on the team. Prior to the lesson, teachers submitted the materials they would be using, so observers had access to all slides and handouts during lesson.

Results



Conclusions & Next Steps

Developing and using this observation tool allowed us to:

- Overcome constraints and difficulties of classroom observation during ongoing COVID disruptions
- Gather information about the classroom conditions across our sample
- Detect clear differences across the study groups

Next steps include:

- Examining teacher lesson logs and student exit tickets for the observed lessons
- Putting teacher outcomes into the main effects student outcomes model
- Qualitative data analysis on the 10 minute logs and teacher surveys

Acknowledgements

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