Analyzing instruction in mathematics using the TRU framework: Promising results from a video-based model of professional learning.

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Abstract

Analyzing Instruction in Mathematics using the TRU framework (AIM-TRU) is a research-practice partnership that is investigating the pressing problem of supporting teachers in increasing their capacity to implement high-quality instructional materials in the classroom with fidelity. Drawing upon the design-based research paradigm, the partnership has worked to co-design, investigate, and iteratively form the AIM-TRU Learning Cycle, which gives teachers the opportunity to understand the materials and how they are used in the classroom through a video-based professional learning cycle. In this poster, this cycle is fully explicated for those interested in bringing it to their own environment, and early findings are shared documenting the positive change by which teachers have built their knowledge around the high-quality instructional materials, the framework that they were built around, and the frequency with which they have used the materials in their classroom. Implications for future work measuring how implementation within the classroom and supports for the teacher leaders leading the AIM-TRU Learning Cycle are discussed.

The capacity to use curriculum well

As recent work shows, one of the critical factors in supporting teachers enactment of the curriculum with integrity in the classroom is supporting teachers in understanding not just the curricula itself but also the way that it is designed in order to optimally use the materials within the context of their classroom (Chopin, 2011; Remillard & Kim, 2017). The AIM-TRU research-practice partnership works toward this problem by thinking of a coherent system involving a video-based learning cycle focused on the investigation of the use of high-quality instructional materials in the classroom grounded in the Teaching for Robust Understanding (TRU) framework. Here, we introduce the TRU framework and Formative Assessment Lessons (FALs) before talking about the AIM-TRU learning cycle in the next section.

In order to build a framework to describe what makes certain classrooms more mathematically powerful, Schoenfeld distilled certain core ideas found over multiple years watching classrooms, resulting in the development of the Teaching for Robust Understanding (TRU) framework, which has five dimensions that are essential in creating powerful learning environments and "necessary and sufficient for the analysis of effective classroom instruction" (Schoenfeld, 2013; p. 607). These dimensions are (a) The Mathematics; (b) Cognitive Demand; (c) Equitable Access to Content; (d) Agency, Ownership, and Identity; and (e) Formative Assessment (see Figure 1).

If it is known what makes for powerful classrooms, then an important step would be to design materials aligned with the TRU framework in order to support teachers in creating rich learning environments. The first set of materials developed by the Mathematics Assessment Project (MAP) aligned with TRU were 100 "Formative Assessment Lessons" designed to support the kinds of rich instruction proposed by the five dimensions of TRU as well as the Common Core State Standards. These lessons, which span middle and high school, are designed so they can be inserted within the curriculum that teachers are currently using to help teachers formatively assess students by having them engage in carefully constructed tasks that are grounded in research on what students find difficult (Schoenfeld, 2014). When FALs are implemented with integrity, learning environments that are well-aligned with the five dimensions of TRU are created.

About the AIM-TRU Learning Cycle

Participants engage in the AIM-TRU learning cycle by focusing on one lesson and its associated video case. Each session begins by starting to think about the big mathematical ideas behind the lesson. This may take the form of understanding the diversity of representations within the lesson, or placing it in the context of what comes before and what comes next. Once participants have started to think about the central mathematical ideas, they then grapple with the same mathematical task in the formative assessment lesson that videotaped students tackle. This practice of doing the math before video watching is similar to other video-based professional development models (Borko, Koellner, Jacobs, & Seago, 2011). After participants have worked through the task, discussed the various solution pathways that students could take, and relate those solutions to the central mathematical ideas, they gain context for the video case, which is often taken from a participant's classroom. At this point, participants watch a short video clip where students are engaged in mathematical talk as they grapple with the task. The video case is discussed using one of the dimensions of TRU, in order to give a perspective on the classroom that is not purely focused on the mathematics of the task. Finally, the participants and facilitators plan the next session.

Participants also take the role of members of the video case team (Figure 1), where they volunteer their classroom as a site for case development as they implement one of the formative assessment lessons. In this role, teachers work with the research team to select the segment of video in order to create the video case, as well as the dimension of TRU that they felt would yield the richest conversation with other teachers.

While we encourage videotaping to occur between sessions, we understand that there are contexts where that would not be possible. In order to help, we have built a video case library that others may pull from.

For more information on our learning cycle, please see our supplementary files for a video explaining our cycle, a facilitation guide and other materials.

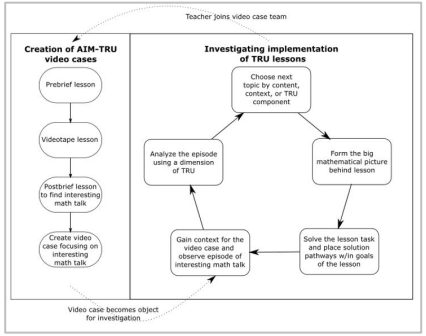

Figure 1. The AIM-TRU Learning Cycle

Methodology

The AIM-TRU learning cycle was implemented in three different sites: Buffalo, Chicago, and New York City. In each site, the model is led by a pair of teacher facilitators, allowing the principal investigators at each site to become participant observers. In New York City and Chicago, one group met during year one, while in Buffalo, two groups (one representing middle school and another representing high school teachers) met. Each site meets around once a month, and working through the AIM-TRU learning cycle takes around 2.5 hours. Overall, 8 teacher facilitators led the AIM-TRU learning cycle for 42 public middle and high school teachers.

A pre/post survey was conducted in order to understand how confident teachers felt about their understanding of the instructional materials as well as the TRU framework. The pre/post survey also asked how frequently they used the resource in their classroom. A paired sample t-test or Wilcoxon signed rank test was used as appropriate considering whether the data was parametric or not. Classroom observations were also taken, with results based on the TRU Math Rubric forthcoming as a part of later work of the grant.

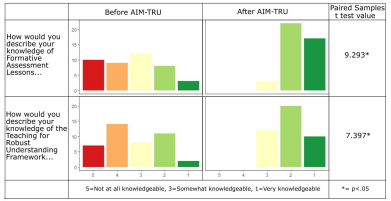

Figure 2. Pre/Post Survey results from Year 1 around knowledge of TRU and Formative Assessment Lessons

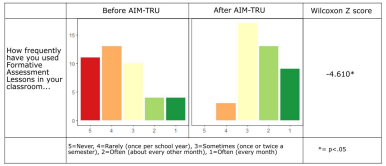

Figure 3. Pre/Post Survey results from Year 1 around use of Formative Assessment Lessons

Discussion

Our early work with the AIM-TRU learning cycle involved using a conjecture map in order to iterate on the design for maximum effect (Russell, DiNapoli, & Murray, submitted). However, an important part of the design-based research paradigm is putting theory in harm's way (Brown, 1992), and ensuring at multiple points that the theory of action is valid. In the first year of our work, our pre/post survey gave us the earliest opportunity to validate our design by seeing an increase in teachers perception of their capacity to enact FALs within their classrooms with integrity. It also showed us that teachers were not only gaining in knowledge of the curriculum, but by increasing their pedagogical design capacity, they were also increasing the likelihood that they would use the curriculum in their classroom.

The AIM-TRU research-practice partnership looks forward to continued work to validate the model by drawing from participants' classrooms. However, we don't want to understate the importance of these preliminary results: through orchestrated conversations around enacted curriculum in video-cases, teachers feel more confident in their ability to understand and implement the curriculum in their own classrooms with an integrity gained by their understanding of a framework of powerful mathematics teaching. Not only this, but through greater understanding, they are also more likely to use the curriculum in the first place.

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