

DynaLabs for Teachers to Collaborate on Pedagogical Strategies

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Abstract: Developing students' argumentation skill is now important in many countries. We report on new tools for teachers to construct, share, and iteratively refine idealized dialogues with imagined students. Such tools can become the heart of a laboratory experience in which teachers collaborate around their possible responses to student reasoning. Our design-based research suggests a laboratory experience for teachers should include four components: a case that challenges teachers, research-based resources that can inform teachers' thinking, a tool for respond constructively to the challenge, and a rubric for formative assessment.

Major Issue Addressed

Engaging students in learning 21st century skills is a major thrust of educational reform globally. From the CSCL perspective, one of the most relevant 21st century skills is *argumentation* – using discourse to explain and justify reasoning and to engage others in collectively improving the group's reasoning (Andriessen, Baker & Suthers, 2003). Another highly relevant skill is *model-based reasoning* – using simplified, abstract representations to reason more effectively about more complex underlying situations (Lehrer and Schauble, 2006). Argumentation and model-based reasoning are now specifically identified as mathematical practices that characterize successful student reasoning in the new Common Core State Standards in the United States.

In the context of our Proportionality Dynabook project, we have been conducting design experiments relevant to this challenge at two California universities that prepare future mathematics teachers. California is in the midst of transitioning to a “clinically-based model” of teacher professional development, which aims to engaging teaching candidates in situations that authentically elicit the “problems of practice” (Darling-Hammond, 2008). This includes supervised field experiences for preservice teachers, but also includes the idea of simulating real teaching during coursework.

In this poster, we report on a particular insight arising from design research: that new tools for teachers to *construct, share, and iteratively refine* idealized dialogues with imagined students can become the heart of a *DynaLab*, a laboratory experience in which preservice teachers collaborate in order to understand what teaching argumentation, model-based reasoning, or other advanced practices might look like at the level of teacher-student interactions. We focus on one of several labs under development, a lab in which teachers read and discuss the research-based learning progression for the concept of *ratio*, then watch a video of a student struggling to solve a ratio problem, then in collaborative dyads develop a script for how they would teach that student, and engage in formative assessment.

Potential Significance

We see our contribution as deeply reflecting the conference theme, “to see the world and a grain of sand.” At the “world” level, policy documents are changing to reflect the importance of new kinds of knowledge and skills. Yet, the important acts of teaching and learning that develop these skills often occur at the “grain of sand” level. New activities and tools, such as we propose in our DynaLab concept, are necessary to enable teachers to connect broader goals to specific classroom practices.

Methodological Approach

The methodological approach in our Dynabook project has been Design-Based Research (DBR, Cobb et al, 2003) – our process aligns with Wang and Hannifan's (2005, p. 6) characterization of DBR as “a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories.” Our specific approach to DBR emphasizes *co-design* (Penuel, Roschelle & Shechtman, 2007) between researchers, technologists, and practitioners.

A DynaLab Design using Dynalogue

Schematically, a DynaLab has four components. First, a DynaLab has a plan with specific objectives and accompanying materials that stimulate or elicit the participants' engagement with an open-ended “problem of

practice.” Ideally, such materials should evoke authenticity and present opportunities for collaborative work among teachers. Second, a DynaLab has research-based knowledge resources which can help participants to learn how to better address the problem of practice. Third, a DynaLab has specific tasks aligned with objectives that give participants the opportunity to respond to these challenges collaboratively, to compare and critique their solutions, and to engage in reflection and refinement of their solutions. In particular, a DynaLab activity engages participants in constructing a detailed artifact as their response. Fourth, a DynaLab has an assessment rubric that can be used for formative assessment, to improve the solutions and to improve the design of the lab, and the discourse that evolves in the process. The most innovative feature of our design is “Dynaologue,” a new tool for writing, sharing, and revising dynamic dialogues. As shown in Figure 1, the dialogue is written in bubbles that are spoken by two animated characters, in the style of familiar smartphone messaging tools.

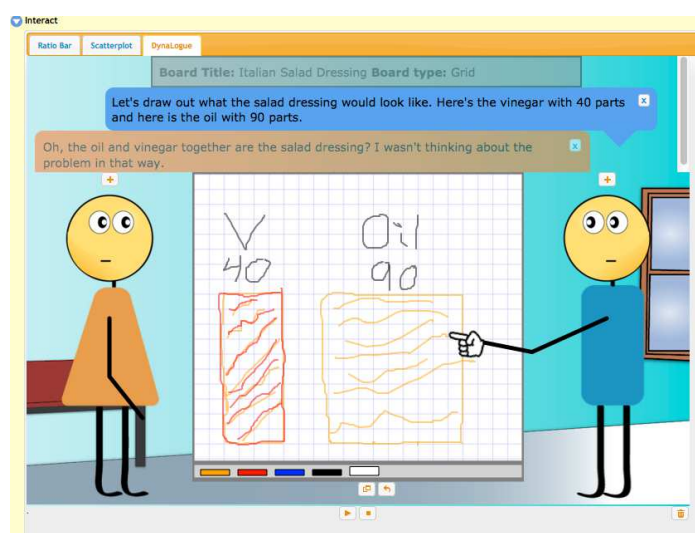


Figure 1: A Dynaologue, showing how a teacher might use a visual model to interact with students

Preliminary Findings and Next Steps

We have found that the DynaLab concept is highly attractive to teacher educators who are charged with preparing a new generation of mathematics teachers. The DynaLab concept is seen as useful as it is grounded in authentic problems of practice but allows for cycles of constructing, sharing, reviewing, and refining teacher-student dialogues within the structure of existing teacher preparation courses. Going forward, more research is needed to establish the comparative advantage of DynaLabs for developing teachers' knowledge and pedagogical skills, relative to other forms of teacher professional development.

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