The Video Mosaic: Design and Preliminary Research

Cindy E. Hmelo-Silver, Carolyn A. Maher, Grace Agnew, Marjory Palius
Rutgers University, 10 Seminary Place New Brunswick, NJ 08901
cindy.hmelo-silver@gse.rutgers.edu, carolyn.maher@gse.rutgers.edu, gagnew@rci.rutgers.edu
Sharon J. Derry, University of Wisconsin, 1025 West Johnson St, Madison WI 53706
derry@education.wisc.edu

Abstract: The Video Mosaic is a collaboration portal that integrates the Davis Institute video collection capturing mathematics learning across a range of grades, schools and a span of 20+ years. We present preliminary research using the VMC for teacher professional development.

A common approach to teacher professional development (TPD) in mathematics education focuses on teachers' content knowledge for teaching by engaging them in tasks that represent major conceptual strands in mathematics, and encouraging them to connect lessons learned from this problem solving to classroom practice (Philip et al., 2007). Video allows learning to be studied in the complex contexts in which it naturally occurs (e.g., Brown 1992). An important aspect of video data is that it enables one to study how learning actually unfolds in context (Darling-Hammond, et al., 2005). Teachers do not ordinarily have the opportunity to study in detail how students in their own classrooms learn. This makes video especially useful for research on learning and teaching as well as for TPD (e.g., Lampert & Ball, 1998). Collections of video provide a source of data for careful analysis and reflection on practice. While large-scale projects often collect large amounts of video, often only a small subset of the video is relevant for addressing particular research questions. This video can be productively used beyond the projects for which they were collected with great investments of time, effort, and money. This argument echoes recommendations made by a recently-commissioned NSF report on video research in education (Derry et al., 2007), which emphasizes the important role of cyber-enabled video tools in achieving this goal. Video tools make it possible for teachers and researchers to observe students' learning of mathematics and reflect on students' potential for doing mathematics (Powell, Francisco & Maher, 2003).

The Video Mosaic

The Video Mosaic (VMC; www.videomosaic.org) is a collaboration portal that integrates the Robert B. Davis Institute for Learning Video Collection, which captures mathematics learning across a range of grades, schools and a time span of 20+ years, with a collaboration platform and tools designed to transform mathematics teaching and learning research (Maher, 2005). The VMC combines innovative research into the teaching and learning process with videos and tools to enable teachers, teacher educators and researchers to analyze and use the videos to make new discoveries in math education and the learning sciences (Agnew, Mills & Maher, 2010).

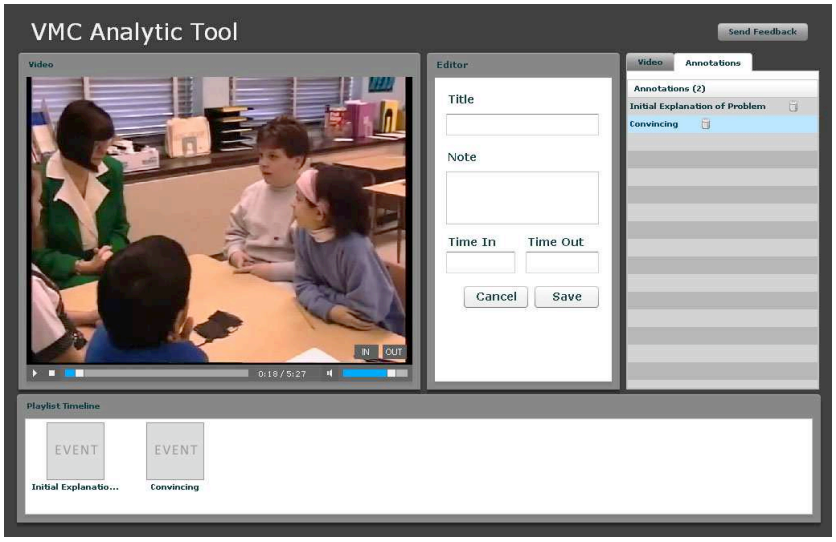

Figure 1. VMC Analytic Tool

This project has involved development of the VMC repository and pilot studies of TPD. The VMC has been constructed to preserve videos, catalog resources using the METS (metadata encoding and transmission standard) and develop a prototype analytic tool to enable individual and community use of videos (Agnew, et al, 2010). Developing an analytic tool for a large, complex video collection that would support both individual and collaborative analysis is a key challenge. Video analytics can range from simple coding to complex interpretive

texts that must be associated with the appropriate video it analyzes, and are thus metadata; but these analytics are also creative works and need to be afforded the same treatment as the video that it analyzes. Analytics are thus information objects in the repository that can be associated not only with the video being analyzed but also another analytic, as when an instructor creates an analytic to critique a student's analytic.

Preliminary Design Research

We are studying the VMC through a program of design research (Bielaczyc, 2006). We conducted pilot studies using VMC in interventions that used video cases showing multiple forms of reasoning in a range of school settings, math content, and grades. We developed instruments to measure beliefs about teaching and learning mathematics, content knowledge, and a video assessment of ability to recognize forms of mathematical reasoning. These studies were conducted at three preservice sites and one inservice site with elementary and middle school teachers. In a typical intervention, teacher-learners collaboratively engaged in challenging mathematical tasks with manipulatives available for building models from which they could reason and develop solutions. They shared solutions, representations, and justifications. Following their own problem solving, teacher-learners studied children working on the same task. Our analysis of teacher beliefs (Table 1) shows that there are two factors: one related to beliefs about student learning and another about effects of teaching, and that these beliefs are positively affected (shown by lower scores) by participating in VMC interventions.

Table 1, Teacher Beliefs

	Factor 1 Score		Factor 2 Score	
	Pre	Post	Pre	Post
Mean	1.95	1.58	2.34	1.94
Standard Deviation	0.63	0.55	0.43	0.56
$T(69)$, all $p < .001$	4.97		7.42	

Conclusions

The VMC is demonstrating the use of cyber-enabled technologies to build and share adaptable interventions for TPD that effectively make use of major video collections and have high promise of success at multiple sites. The cyber infrastructure provided by the VMC and significantly extended through this project is supporting development and documentation of furthers interventions for TPD using this video collection, as well as other videos that might be added in the future by teacher educators or researchers, including those working in other STEM domains. Future research will examine how interventions in different contexts over different iterations affect teacher learning and try to better understand the characteristics of different interventions.

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