Approaches to Using Video Cases in Teacher Professional Development

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Abstract
Design In The Classroom (DITC) is a teacher professional development program that uses videos and related materials to support middle-school science and tech ed teachers in learning about, implementing and managing design tasks successfully in the complex realm of classroom teaching. Cases are reported of how these interactive multimedia materials were used by teachers in Massachusetts and Georgia. One study compared one group of teachers who used DITC in conjunction with doing a model parachute design challenge with a similar group that relied upon published teacher materials. The effects of using “video timelines” in providing a video gestalt of an entire instructional unit and “video hotspots” in focusing users’ attention on specific movie events are discussed.

1. Introduction to DITC and its approaches to using videos in professional development

The use of videos for teacher professional development (TPD) has received increasing attention since their initial use in the 1960s. Stigler et al. [1] used video survey methodology and video cases in the Third International Mathematics and Science Study, TIMSS, which enabled viewers to do cross-cultural comparisons of teaching practices in different countries. Sherin et al. [2,3] have described how teachers participating in year-long video clubs developed “professional vision” and evolved from noting teacher actions and strategies when viewing their own and others’ classroom teaching videos to focusing on student meaning-making and learning.

The Design In The Classroom (DITC) program is an NSF-funded TPD project that has been developing digital movies and accompanying materials for pre- and in-service middle-school science and tech ed teachers, and is available via CD-ROM, DVD movies and the Internet [www.cc.gatech.edu/projects/DITC]. Numerous edited video sequences in DITC contain scenes of classroom instruction, student group work, and interviews that aim to give teachers a “video gestalt” of what using standards-based, hands-on design challenges that contextualize and motivate students’ learning of skills and ideas in science, mathematics, engineering can be like in the classroom.

DITC has been designed for use by teachers with a facilitator, and presents tutorials on how the objects students are designing work, introduces pedagogical strategies related to doing design with students, provides video vignettes of students working in groups, and details typically encountered student misconceptions. Its professional development goals for teachers include having them:
• Explore and use design tasks with their own classes;
• Elaborate upon and make connections with their own knowledge of subject and pedagogy;
• Focus attention on key events in classroom videos;
• Reflect and dialog about videos with other educators;
• Explore and do long-term teaching experiments; and,
• Help students move from doing trial-and-error to doing informed designing.

Figure 1. Timelines let users compare movies of two implementations of the same task

Among its other video approaches for TPD, DITC uses video timelines to provide clickable access to sequentially ordered sets of movies that provide an overview and gestalt of an entire activity’s implementation. Figure 1 shows a tech ed and science teacher’s timelines for the same parachute design unit.

Figure 2. Colored “hotspots” help users focus on and differentiate multiple design strategies

DITC also attempts to get users to focus attention (van Es and Sherin[3]) on specific aspects or events of videos, such as the design strategies students use when working together. Video hotspots (see Figure 2) are a scaffolding technique described by Rand Spiro and others that are translucent circles of various colors placed during editing over a subject’s face or an event. Each color carries an assigned interpretation; e.g., scientist, manager, designer.

2. Subjects, Questions and Data Analysis

This paper reports on a study involving two groups of three science and mathematics teachers (grades 5-8) from two towns in northern Massachusetts, and a case study of one eighth-grade science teacher from Georgia. The six Massachusetts teachers were enrolled in a university course entitled “Introduction to Engineering for Teachers,” and did as part of their coursework a week-long Learning

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By Design™ design activity. Students were asked to design, build and test model parachutes made of coffee filters, string, masking tape and washers, so that they descended with a given load as slowly as possible. Classes were videotaped or observed by the author or the project’s external evaluator, Jan Ellis from EDC of Newton, MA. Post-tests were administered to all the middle-school students who did the parachute task.

Three of the middle-school teachers (2 science + 1 math) were included in the non-DITC group and prepared for this activity by reviewing LBD™’s teacher materials and attending their college class’ preparatory discussion. Their four classes were observed from late 2002 to early January 2003. DITC teachers (2 math + 1 5th-grade teacher) did the parachute activity with 9 classes in mid-January 2003, and in addition to the above preparation, reviewed the 3.5 hours of DITC video and tutorials before using the unit. During implementation, the author acted as a knowledgeable TPD facilitator, and met with DITC teachers to recommend videos and materials to review.

The research questions posed by this study were:
(1) In what ways did DITC materials help teachers or not in preparing for lessons, managing materials and implementing design-based classroom activities?
(2) What was the impact of the interactive multimedia approaches of video timelines, hotspots and tutorials on teachers’ implementation of the parachute task?

What follows are observations and analysis of trends of non-DITC and DITC teachers’ use of DITC videos, based on classroom observations and follow-up interviews. The making of any firm conclusions or findings is precluded by this study’s small sample size.

All Massachusetts teachers had success in implementing the parachute design challenge and were pleasantly surprised by the sustained level and quality of student engagement. Teachers from both groups were able to adapt the parachute activity to the objectives of their own courses. Non-DITC teachers, however, struggled with the unit in part because they themselves had not explored the “teaching problem space” of an activity; i.e., the topography of what is hard for students, typical naive solutions, and useful teaching strategies. They reported feeling like “a first-year teacher all over again”, spoke at length of the extra time needed for preparation and predicted they would overcome the obstacles and inefficiencies they met after using the activity once or twice. DITC teachers reported that the video timelines helped them with their daily planning, gave them an accessible overview of the entire parachute activity, and noted that their initial plans for conducting the parachute unit were significantly impacted and changed by their initial review of DITC’s materials. Teachers’ reports of being better prepared to teach with this novel activity suggested that DITC’s goal of providing a viable “video gestalt” of a design activity was in some ways reached.

Both groups of teachers communicated some misunderstandings to their students about how a parachute works and the physics of freefall. One non-DITC science teacher used a molecular model to explain air drag, which in parachute design is true but less helpful in making design decisions than a fluid flow model. The latter shows how air current flows through and around a canopy, helps explain why parachutes with greater inflated area generate more drag, and can help tell why designs with multiple canopy layers do not inflate fully (lead canopy creates turbulence). The same teacher revised the design task’s wording to read, “Design the lightest parachute that falls at the slowest rate”. This formulation reflects an Aristotelian notion that heavier objects fall faster than lighter ones and does not acknowledge that some heavier parachute designs could produce more air drag and less net force, resulting in slower terminal speeds than less massive ones. DITC tutorials seemed to give teachers more appropriate explanatory models and helped them identify design features that most influence chute’s performance. DITC teachers were better at telling when students’ test results were influenced by bad data or reached by faulty reasoning, and did strategically plan future lessons to address student misunderstandings.

To support teachers in elaborating and reflecting more upon its materials, DITC appealed to teachers’ pragmatic sensibilities by encouraging them to view its videos with an eye to using them with students. In a final case study, one eighth-grade science teacher from Georgia did so and selected two DITC videos to show her students to get them to analyze other students’ design work and then to think metacognitively about their own design processes. She had her students view videos that used hotspots to indicate unnamed designer roles that other students employed when working at the parachute challenge. During the ensuing discussion (see the “Teaching Experiment” movie on the DITC website), students successfully named design strategies noted by the “hotspots” feature. Students animatedly discussed and made numerous statements that suggested they successfully reflected upon their own and others’ design work. The teacher agreed that videos helped her students become more metacognitive about their designing.

3. References