Supporting Science Teachers' Professional Development with Video and Audio Podcasts

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Abstract: Grade 8-12 teachers participating in a physics professional development program were required to present, critique, and reflect upon lessons that pertained to specific physics content, and physics teaching content-pedagogy. These weekly activities were posted to the World Wide Web in a blogging content management environment. The study presents qualitative data on the utility of personal on-demand audio and video as a tool in teacher professional development. This has implications for professional development programs that integrate a distance education component, as well as in exploring modalities for teacher training, mentoring, and reflection.

Introduction: Strategies for Teacher Professional Development in Physics

The need for well-prepared physics teachers is very high in K-12 education today. The general need for science and mathematics teachers is so great that a number of government-funded programs have been created to increase both the numbers and skills of teachers in these fields. Federal Law has provided specific legislation, including the No Child Left Behind Act ("NCLB Act") of 2001, which both funds professional development programs for science teachers, and provides non-traditional routes for entry into these fields (US Department of Education, 2007, PL 107-110, pages 201 & 219). In many predominantly minority border communities, science teachers, and in particular, physics teachers are particularly rare (UTEP CIERP, 2005). The Texas Teacher Quality Grants are funded under the No Child Left Behind Act of 2001, Title II, Part A, and the Texas Teacher Quality Grant program is described as "*…a federally funded effort providing grants to higher education institutions and nonprofit organizations to promote improved instruction in mathematics and science for Texas schoolchildren by providing professional development for their teachers*" (U T Dana Center, 2007; US Department of Education, 2007). Texas Teacher Quality Grants funded by the NCLB act require that teachers participate in an intensive three-week face-to-face workshop, but then provide a number of flexible professional development training options as long as the approaches are high-intensity, sustained, and high quality. In recent years the grant program has sought to explore how technology-mediated tools might support the programmatic goals of sustained, high-intensity and high quality professional development (Powers, 2007). Because personal reflection has been associated with robust teacher professional development (Schön 1983, 1987; Blakey & Spence, 1990), and because the authors of this paper had begun a series of audio podcast-based activities to promote teacher mentoring and reflection in previous iterations of the program (Giza, 2007), it was a natural extension of the research to add additional elements to the web-based environment and involve technology tools even further into science teacher content training. In the 2007-2008 version of the Teacher Quality Grant an online component was added in which teachers would participate in three significant ways (1) By developing and videotaping a lesson that taught a particular educational-standards-aligned physics concept; (2) By viewing and critiquing the online lessons created by their peer teachers; and (3) by reflecting upon how their lesson-development and study activities had affected them in audio recordings that were posted to the online content management system.

Free and easy-to-use technology tools

High-quality, reliable web-logging, "weblog" or "blogging" environments are now available for free online, and in order to maximize the interactivity, and to keep prices low, one of the free locations was chosen to create the interactive content management system. A private web-server controlled by the author was used to store the digital media, which was hyperlinked to pages at the weblog. This required the teacher-user to submit text and video first to the project director (the author), and to his graduate student, who would review the videos for size, content, and compatibility, and then put them online. This "filter" ensured that all video online met specific standards – that it

did not exceed 640 y 480 pixels in width and height, that it was in Flash® video format (.swf) for the web, that it did not exceed the 15 minute time limit, and that it was accompanied by the text for the lesson that included specific elements: that it adhered to the well-known science 5E lesson format (Bybee, 2003, Crowther, 2005) that it included a teacher preparation and resources page, addressed any safety considerations, and was appropriately aligned to standards. The tools selected for the video editing needed to be easy-to-use and free or open source (Giza, 2005; OSI, 2005; Raymond, 2004; Stallman, 2005). The audio formats (MP3) and video formats (SWF) were chosen for their near ubiquitous support in online "*Personal On-Demand*" or "*Podcast*" applications. Free tools were used in order to ensure reliability, and compatibility, and to ensure that the process affordable and could easily be replicated.

Technology in professional development is not new, of course. It has a long history of pros and cons (Oppenheimer, 1997, 2003) and of well-documented approaches that include email, digital portfolios (Means, 1993), videoconferencing (Godwin-Jones, 2005), the world Wide Web (Lehnart, 2001), digital storytelling (Latham, 2005),and a variety of online learning environments (Burns, 2005/2006). What sets this particular study apart is that it depends upon the active development of lessons by teachers and their presentation in online audio and video format for teacher reflection in accordance with principles of professional development that are founded in brain theory on how students learn (Blakey & Spence, 1990; Loucks-Horsley et al., 1998; Dewey, 1993; Donovan & Bradsford, 2005)

Procedure

The teachers for the study were recruited from applicants who were fully certified Texas science teachers who were seeking to increase their physics content and content-pedagogy. They were highly motivated to participate because the current classroom teaching assignment that they held, *Integrated Physics and Chemistry* (a course that is taught at the 9th grade level in Texas) was likely to be discontinued in the near future, and they would have to change teaching assignments to another science subject in the near future – and *Physics* was one of the most desirable and reliable assignments available. Many were teaching in schools with large numbers of at-risk students, including high poverty, and second-language learner populations. They were provided an intensive face-to-face summer physics workshop and two additional institutes over the period of the year that they spent in the program that were supplemented with monthly face-to-face Saturday workshops with physics or physics content-pedagogy subject matter. The online learning strategies were designed to ensure that teachers were continuously involved in reflective learning between the monthly workshops and institutes. Teachers in the program are pre-tested and posttested over their mastery of physics kinematics content with the Force Content Inventory (Hestenes, & Halloun, 1992; Hestenes, Wells, & Swackhamer, 1992) and for their feelings of science teaching efficacy, with the STEBI instrument (Riggs & Enoch,1990).

Results

At the time of the submission of this paper the teachers have been recruited, the online weblog location has been set up (at http://utepphysicstq.blogspot.com), pre-testing and initial content training has taken place, and teachers are working to develop their video lessons. Initial technology trainng takes place in November 2007, and in December 2007 the online lesson study cycles will begin, and continue through May 3008, at which time the posttests will be administered. A final online survey and a series of qualitative interview questions will complete the study to identify issues, positives, and negatives, associated with the online professional development approach.

Software sources

Audacity: Free, open-source audio recording and editing software available for the Microsoft Windows, Apple OSX, and Linux operating systems at http://audacity.sourceforge.net.

Camstudio 2.0**:** Free, open-source video-capture and video to Flash recording and conversion software available for Microsoft ® Windows, at http://camstudio.org.

iMovie**:** Proprietary video-editing and DV-capture software provided free with Apple Macintosh ® OSX operating systems.

KompoZer: Free, open-source HTML editing software available for the Microsoft Windows, Apple OSX, and Linux operating systems at http://www.kompozer.net.

***Microsoft ® Movie Maker Version 2.0*:** Proprietary video-editing and DV-capture software provided free with Microsoft ® Windows ® XP Service Pack 2 and above.

***Super*: "*SUPER* © *Simplified Universal Player Encoder & Renderer.*" Proprietary but free file conversion (e.g.: Sorensen codec MOV files to DIVX AVI files) software for Microsoft Windows available at www.erightsoft.com/SUPER.html.

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