The VideoPaper: Issues in Implementation of a Multimedia Tool for Professional Self-Dialogue and Communication in Mathematics Education

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We discuss the nature of multimedia software designed for integrating text and video into professional communications about mathematics teaching, learning, and assessment. Cases that demonstrate teacher professional growth through self-dialogue and peer communication of specific pedagogical insights are exhibited. Critical success factors in implementation of this tool are outlined.

In this paper we discuss the use of a VideoPaper (Nemirovsky, Peterson, Cogan-Drew, DiMattia, & Galvis, 2005) as a tool for promoting professional self-dialogue and communication among 25 middle school teachers enrolled in a capstone course bearing credit toward a Masters degree in Mathematics Education. The capstone course was the final course in a three-year program in which students had the option of completing either a VideoPaper, portfolio, or research project. From 30 total students 25 opted to complete VideoPapers because of various reasons such as the ability to share their teaching experience with others, to reflect on their practice, and interest in the technology. As instructors, we had no idea such a large proportion of teachers would select this option, nor did we envision those critical success factors (Galvis, 2004) necessary for implementation of this project. In this paper we will share some of those factors that our students found necessary as well as some of the successes that made the VideoPaper a unique tool for Mathematics Education professional development.

Using Video to Document Classroom Episodes

Although video has regularly been used by researchers conducting case-based research, it has only recently been used for teacher professional development. Video of mathematics classroom lessons has been used as rich sources of material for the professional development of teachers (Hiebert & Stigler, 2000; Mousley & Sullivan, 1996; Stigler & Hiebert, 1998; Sullivan & Mousley, 1996, Zellermayer & Ronn, 1999), and continues to become widely used as the Internet has evolved to provide general broadband access (see for example, http://www.cfkeep.org; http://learner.org).

What is a VideoPaper?

A VideoPaper is a multimedia document combining video, text, and images (see Figure 1). For example, video of classroom episodes can be aligned with text of transcripts that appear as subtitles. Commentary text describing the video can be imbedded with play buttons that focus the reader directly to the portion of the video to which the author is referring. Still images of student work can be inserted and appear either when called up based on a timeline in a video or via an inserted button allowing the reader to bring up the slide at will. This document allows the author to give a snapshot of a classroom episode or a researcher the ability to display a clinical interview episode to allow the reader access to data to which the researcher is referencing. Once the pieces are aligned, the paper is created in HTML format that can then be displayed on any web browser supporting frame-based web pages (see Figure 2).

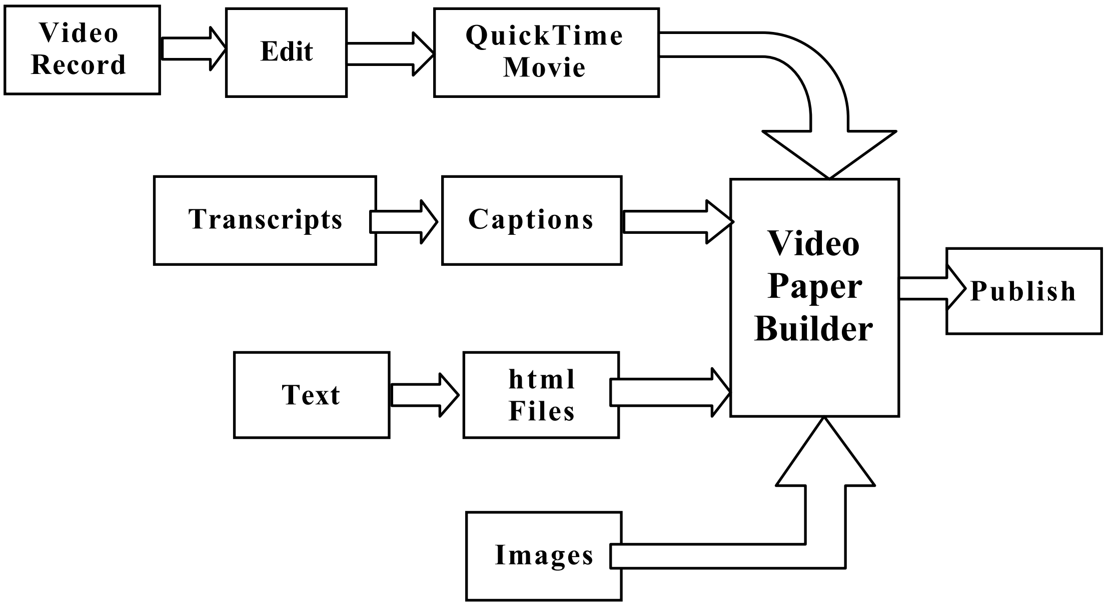

Figure 1. Schematic of VideoPaper construction process.

Figure 2. Example of a published video paper displayed in a web browser.

The VideoPaper author can add a number of features such as overlays, captions appearing in different colours for each speaker, hyperlinks to video and still images, pull down menus, and can hyperlink the page to outside sources that will open as new windows. Open source and freely available software called VideoPaper Builder 3 (http://vpb.concord.org/) enables the author to create a multimedia paper with little or no web authoring background. Figure 3 shows an example of an unpublished VideoPaper in which the author chose to display the video and captions on the right, with the html text describing the video in the middle. The outline on the right will allow the software to create the pull down menus, with the items on the root folder appearing on the initial tabs and the bulleted pages beneath appearing as the drop down choices.

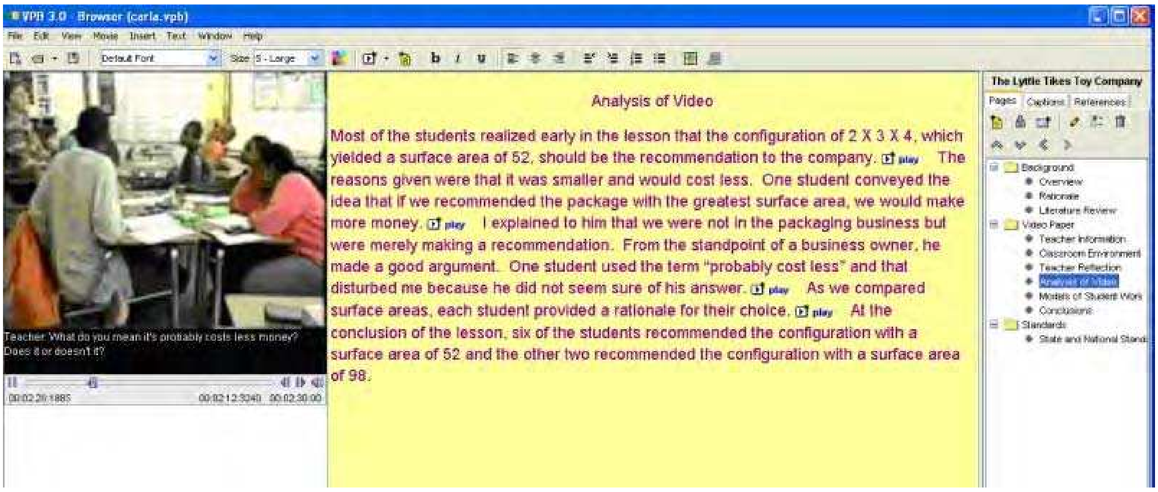

Figure 3. An unpublished VideoPaper

Since published VideoPapers can be displayed on any frame-based web browser they can be used for professional development activities both for the teachers who create them as well as their peers, researchers. Although the teachers featured in this report were highly qualified teachers, the cases studies featured were not intended to be ideal models of classroom instruction as examples to be emulated. The main intent of this project was for our students to think deeply about their own teaching and to consider how the research and methods they had learned in their Masters program impacted their pedagogy and the mathematics content that they teach. "In general, knowledge for teaching is most useful when it is represented through *theories with examples"* (Hiebert et al., 2002, p. 7). The strength of the VideoPaper format allowed our students to align their video, analysis, connection to the literature, and reflection into one product, with the outcome of allowing others to glimpse the bridge from research into practice.

How the VP is a Unique Tool for Mathematics Professional Development

During Spring semester 2006, 25 teachers completed VideoPaper projects in fulfilment of the Capstone course of East Carolina University's Master of Arts in Education (MAEd) program in Mathematics Education. These students had to choose a topic based on their current mathematics teaching, collect video records of instruction and or assessment relevant to that topic, write about this material, including research known to support the topic of interest, and commentary on specific interactions that illustrated approaches to best practice. Our rationale for this project was based on the teacher-researcher model for profession development which "requires teachers to identify an area of instructional interest, collect data, and make changes in their instruction on the basis of an interpretation of those data" (Sparks & Loucks-Horsley, 1990, p. 235). In the process of reflecting on the video records chosen for inclusion in their VideoPaper, and writing about them, these teachers were drawn into self-dialogue.

Example 1. Stacey (Looney, 2006) selected her 8th grade Pre-Algebra class in which she used a combination of whole class instruction, collaborative learning groups, and student presentations. In her VideoPaper she chose to feature whole class instruction. The lesson featured was from a unit on probability and statistics, in which the students collected data pertaining to the total calories in various foods in their kitchen pantry. The students were required to summarize their data in the forms of a line plot, a bar graph, and a histogram. Stacey perceives her classroom as a small community where students work together in teams of 3 or 4 and have opportunities to discuss mathematical thinking and reasoning. Stacey felt that her role as a classroom teacher was as a facilitator and one who created a safe environment where students felt they could take mathematical risks. In Stacey's VideoPaper we are able to observe the set-up of her room, how she conducts her instruction, her students taking mathematical risks as they answer her questions in front of the class, and student responses. In Stacey's reflection on the VideoPaper process, she was excited about having a product that she could use to share with parents and community members so that they could get a snapshot of what her classroom was like:

> The biggest factor in my decision was the opportunity it granted me to show how much I have grown as a professional as well as an opportunity to expand upon that growth. … Creating this document was one of the greatest challenges of my graduate school experience because of my desire to exemplify the knowledge I have gained in an exceptional manner. The countless hours spent agonizing over the smallest of details has taught me patience, perseverance, and total commitment. I am eager to share this knowledge and professional portfolio with my administration, colleagues, parents, and the community. I am especially excited that parents can interact with this multimedia to observe my teaching style, the class environment, and the relationship I have with students. Using this approach to instruction will enable me to reflect and examine my teaching strategy for years to come. Presenting lessons in this way also enables me to pinpoint the changes that need adjusting in my teaching to further enhance student learning. … As a result of this process, I feel confident that I can handle any task that comes my way (Looney, 2006, p. 20).

Example 2. Linda (Coley, 2006) selected 4 groups of 7th grade academically advanced students working on an Algebra problem; Find the Function (Erickson, 1989). This class had just recently been introduced to the concept that lines have equations that include y-intercept and slope values. Her data spanned several class periods as well as individual interviews. Linda saw herself as experienced in teaching mathematics from a problem-based learning perspective (Gijbels, Dochy, Van den Bossche, & Segers, 2005), having used this approach for three years, but lacking in expertise with technology. Linda's VideoPaper presents brief segments of group interaction embedded in written commentary of problem solving behaviour. In commenting on one group of three students — Caroline, Brandalyn, and Savannah — Linda observed:

> At one point in this portion of the video you can see Caroline look at her clue (a strip of paper with information for solving the function problem) and then interject a question about the points. Her question is ignored by her group and (the) other two girls come to a consensus about the coordinates. In this clip the demographics of this cooperative group is apparent. Savannah and Brandalyn are outspoken, problem-solvers, Caroline generally waits and thinks about different aspects of the problem before she makes any decision about the answer. Through this type of group interaction the students create a mini-environment of problem solvers, where one person steps up as the leader or manager of the group while the other members follow their lead (Coley, 2006, p.6).

Linda then reflected further:

> At times you can see how the problem-based task that is being used can pull, from a normally quiet

> student, knowledge that the group needs. In this case Brandalyn is normally fairly quiet in full class discussions but in the small group setting she verbalizes her thoughts and discusses her knowledge with other members of her group (Coley, 2006, p.6).

Linda noticed that a student who doesn't usually stand out in the whole class instructional setting takes a more prominent role in the small group setting. She attributed this role reversal to the didactic strategy employed, and seemed comfortable implying that this instance was representative of a general phenomenon. She concluded, "Within a small group individual members are more apt to share their expertise (p. 6)".

We see in the following excerpt from her commentary how Linda had been able to think deeply about her students' understanding of linear functions, showing an ability to attribute depth of understanding despite a somewhat inadequate response to a question:

> Jimmy responds to my question about "What else could you tell me by looking at a line graphed through two points?" Jimmy responds, "Where it's next point may be." He continues with explaining that," If you have a line that is going like this then you can kinda tell that the next point might be somewhere along this line." My response to Jimmy's comment is that this would be at best a guess. I clarify that I want to know what could absolutely tell from graphing these point, I call on Laura, who I hope will have the right answer, and she indeed pulls out the concept of using this set of points to find the y-intercept from the graph. Her explanation of how to find that "Seeing where the x and the y come together " is flawed but her understanding of what a graph can tell you about a linear equation is impressive (Coley, 2006, p. 8).

Linda communicated enthusiasm for her work, and explained why she believed the problem-based approach worked for her, in her summative personal reflection:

> As a graduate student, Nationally Board Certified teacher and a mother I have seen many different views of what a classroom should look like. I have seen straight rows with no talking, cooperative groups with little student-to-student interaction, and classrooms that function around, what would be considered by most, chaos. Of all the methods I have used and seen, none excites me more right now than problem-based learning experiences for students. I have seen the looks that the students have of interest and engagement as they are working through mathematical puzzles that mean something to them. I have watched as students who in a typical environment stay quiet become quite enthralled by the question that is before them. In each instance, I believe that the environment a teacher creates for students to think independently and construct meaning for themselves is key to student mathematical understanding and retention (Coley, 2006, p. 12).

Critical Success Factors

Critical success factors (Galvis, 2004) that enabled or constrained our students in completing their VideoPaper project included: availability of necessary technology, a realistic understanding of the time involved, a vision for the finished product, and technological proficiency. Each of these factors was instrumental in student success in completing the project.

Necessary technology. Although the VideoPaper Builder 3 software (http://vpb.concord.org) can run on relatively minimal computer systems, we found that some of our students did not possess much more than basic technological skills. Although all had the minimum technology at the schools where they worked, some network administrators did not allow them to install the software that would enable them to work on their paper there. Thus the only recourse they had was to drive to the university after school hours and on the weekends to use the available computer lab. This put the burden on the instructors to be available on nights and weekends to give them access to the computer lab.

Another technological issue that constrained many students was in video editing. The students had to select what sections of typically an hour of classroom video to feature and then edit that video by cutting the desired clips and joining them together as one video. We found that in the beginning of the project, none of our students had any knowledge of video editing nor did they have the equipment or software necessary to complete the task. The students had video ranging from VHS tapes, Super HI-8, to mini digital video CD's that were captured from digital cameras. It was essential to capture all the media in digital format and to save it as either a .mov or .mpeg file. This digitising video was, for the majority of the students, the greatest obstacle to overcome.

Time factor. We found that many of our students perceive the VideoPaper option to be the easiest of the three options they were given. What they did not understand was the time factor involved in creating the paper. There were unplanned issues with video formatting, time to decide what section of the video to feature, transcription, and issues in putting all the pieces of the VideoPaper together. This misunderstanding of the time involved to create the paper was a critical issue in student success in this project.

Vision for the final product. One of the most influential factors in the quality of the projects we received was the initial vision for what the project would look like. Significant thought and self-reflection was involved for the students to determine what 10-minute portion of up to an hour of video they wanted to feature in their analysis. The students had to grapple with issues of determining the segments of video, transcribing the desired sections, editing the sections to create one video clip, and then putting the project together, deciding where to put hyperlinked play buttons to feature certain sections of the video, and timing transcript captions to correspond to the video. These tasks became overwhelming to some students and were such a focal point that the students lost sight of the content of the paper and the "big picture" they were presenting. They were so caught up in each of the pieces that they lost the objective of the project.

Technological proficiency. Although there was a broad range of technological abilities, all of our students were eventually successful at producing a VideoPaper. The students who were more technologically proficient had fewer problems in working with the actual software, however the majority of students had difficulty with appropriate video format. Although technological proficiency is assumed to be a major critical success factor, it was the least critical of the factors previously mentioned. One possible reason may be the detailed users manual available on-line.

Conclusion

The VideoPaper is a multimedia tool that stimulated our Masters students to focus on issues of mathematics teaching and learning grounded in their own classrooms. To that extent, their insights have potential to impact their peers, administrators, parents, and the community at large, in a novel way. These communications are accessible wherever there is Internet broadband connected to a computer. We have described features of the VideoPaper, including the video, text, captioning, image, and publishing components. We provided case examples illustrating how engagement in these projects can require the teacher to think deeply about how they teach mathematics, how individual students learn mathematics, and what kinds of social settings seem to enhance that learning. They have noticed that certain students, who seem relatively invisible in large group contexts, flower when placed in smaller groups. They have been able to validate reform-based admonitions in practice that would otherwise be confined to academic knowledge gained from the University classroom. Many of them expressed excitement at the prospect of being able to share their project results and perspectives with peers, administrators, and parents. The VideoPaper is a useful tool for developing mathematics leaders in classrooms and the community.

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