Video Annotation Tools

Technologies to Scaffold, Structure, and Transform Teacher Reflection

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Abstract: While video has long been used to capture microteaching episodes, illustrate classroom cases and practices, and to review teaching practices, recent developments in video annotation tools may help to extend and augment teacher self-reflection. Such tools make possible the documentation and support self-analysis using verifiable evidence as well as to examine changes in development over time. Video annotation tools offer the potential to support both the reflection and analysis of one’s own teaching with minimal video editing as well as the ability to associate captured video with related student and teaching evidence. In this paper, we compare and contrast emerging video annotation tools and describe their applications to support and potentially transform teacher reflection.

Keywords: video; self-analysis; teacher education; reflection

As Schön’s (1983) conception of teaching as reflective practice has been widely embraced, the importance of critically reflecting on teaching practices has become increasingly important. For example, the National Council for Accreditation of Teacher Education (2008) recommends, “Field experiences allow candidates to apply and reflect on their content, professional, and pedagogical knowledge, skills, and professional dispositions in a variety of settings with students and adults” (“Target,” para. 1). Reflective practice is emphasized throughout several of National Council for Accreditation of Teacher Education’s current standards (e.g., 2c, 3b, 3c, 4c, 4d, 5b, and 5f). The Interstate New Teacher Assessment and Support Consortium (1996) also focuses specifically on reflection and professional development: “The teacher is a reflective practitioner who continually evaluates the effects of her/his choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally” (Standard 9). Furthermore, the Teacher Education Accreditation Council (2008) recommends that claims to cultivate reflective practitioners are supported by assessment evidence related to teaching experiences.

Although considerable literature has been published, research on the outcomes of reflective practice has been scarce. Reflection was not addressed in the 800+ page report published by a comprehensive review of research in teacher education spanning the preceding 25 years (Cochran-Smith & Zeichner, 2005). Korthagen and Wubbels (2001), proponents of reflective practices in teacher education, suggest that reflection relies “heavily on comments made by student teachers during course evaluations, as well as on self-reports, general observations, and isolated anecdotes” (p. 89). However, in a criticism of reflection as practiced among teacher educators, Zeichner and Tabachnick (1991) noted,

In some extreme cases, the impression is given that as long as teachers reflect about something, in some manner, whatever they decide to do is all right since they have reflected about it. (p. 2)

Authors’ Note: The authors thank the reviewers for the feedback we received in preparing this manuscript for publication, whose recommendations helped this become a more cohesive paper. The authors also thank the cooperation of the coordinators of each video annotation tool mentioned in this review; namely, Daniel Cogan-Drew, Larry Farmer, Michael Preston, Keven Prusak, Art Recesso, Miriam Sherin, Reed Stevens, and Beth van Es.
In an era of increasing accountability, we need to examine both the processes as well as the impact of reflective practices.

Video technologies may afford largely untapped potential to support and document the processes and impact of reflective practices. Although video has long been used for self-confrontation (Fuller & Manning, 1973) and for examining one’s own teaching practices (Grossman, 2005), recent developments in video annotation tools make video reflection increasingly viable and accessible. Such tools make possible the documentation and support of teacher self-analysis using verifiable evidence (Bryan & Recesso, 2006; Rich & Hannafin, 2008b; Sherin & van Es, 2005). Video annotation tools offer the potential to support both reflection and analysis of one’s own teaching and to link captured video with related evidence. The purpose of this article is to compare and contrast available video annotation tools and describe their applications to support teacher reflection.

**The Changing Role of Video in Teacher Education**

Since the 1960s, teacher education programs have routinely used microteaching activities, wherein preservice teachers teach and record brief lessons to peers and receive feedback from both peers and supervisors. According to Grossman (2005), “microteaching grew out of the process-product line of research, which identified particular teaching skills that correlated with gains in student achievement and then tried to teach these discrete skills to teachers” (p. 429). Typically, this research demonstrated changes in preservice teachers’ behaviors and actions (Copeland, 1982; Perleberg, 1987).

With the emphasis on cognitive models in the late 1980s and 1990s, video-based research refocused to using video to examine teacher thinking, decision making, and reflection. Hypermedia databases, often in the form of videodisc cases, provided examples of model teacher practice (Lambdin, Duffy, & Moore, 1997). Video cases have since become prevalent in preservice teacher education (see, e.g., Barnett, 2006; Berg, Jansen, & Blijleven, 2004; Harris, Pinnegar, & Teemant, 2005; Teale, Leu, Labbo, & Kinzer, 2002; Trier, 2003). Web sites such as InTime, TeachScape, LessonLab, CaseNext, and TeachFirst provide online video cases depicting the practices of expert educators (Pea & Hoffert, 2007) for inservice and preservice teachers.

Although powerful and versatile, these applications primarily record or present rather than parse teaching events. In this regard, linear video provides important holistic snapshots but is often difficult to systematically observe, analyze, or reflect deliberately on individual teaching practices (Hewitt, Pendretti, Bencze, Vaillancourt, & Yoon, 2003). During recent years, video annotation methods have emerged that afford even greater power and utility for examining and improving reflective practices.

**The Emergence of Video Annotation Tools**

Video annotation tools allow an individual to both capture and analyze video of personal teaching practice, enabling teachers to review, analyze, and synthesize captured examples of their own teaching in authentic classroom contexts. These tools provide potentially important methods for scrutinizing instructional decisions within a specific teaching context (Stevens, 2007). Video analysis programs such as Transana™ (www.transana.org), DIVERT™ (diver.stanford.edu), and Constellations™ (orion.njit.edu) provide significant data-mining capabilities, management, and fine-grained analysis and reporting.

Despite extensive use by researchers, few tools have been applied to scaffold and support teacher reflection. In the remainder of this article, we examine how researchers currently use video annotation tools and how these tools have and might further contribute to the study and utility of reflective practice in teacher education.

**Procedures**

We identified studies wherein teachers used a video annotation tool to record, annotate, and reflect on their own teaching. Initially, we conducted a review of published research by searching the ERIC, SSCI, PsycInfo, Academic Search Premier, and digital dissertation databases using the following search terms: video, self-reflection, evaluation, teachers, and video analysis tools. Using key articles (e.g., Fuller & Manning, 1973), we performed a Highly-Cited search using the ISI citation index to identify additional studies. Our efforts yielded 72 manuscripts, including teacher reflection, self-analysis scaffolding techniques, personal video editing, collaborative video analysis, and Internet conferencing. Of these, seven articles or conference presentations involved the use of a video annotation tool: the Video Analysis Support Tool (VAST), the Video Analysis Tool (VAT), and Video Paper. We then contacted researchers who had previously published or presented video annotation studies at national conferences to obtain additional nonindexed, preprint research studies, or those not captured by our search terms. This resulted in 10 additional manuscripts describing three additional tools: Video Interactions for Teaching and Learning (VITAL), VideoTraces, and MediaNotes.
Finally, we identified literature related to several candidate tools that might meet our criteria for inclusion: (a) was used for analyzing one’s own teaching in an authentic situation (i.e., not microteaching), (b) supported video annotation, and (c) was currently available. We then excluded video tools built specifically for analyzing case studies of expert teachers’ instruction, such as the Case Technologies for Literacy Learning, Harris Video Cases, and the Reading Classroom Explorer, that did not meet criterion a and often failed to meet criterion b. Other tools (Constellations, DIVER, StudioCode, Transana, VideoAnt, and Viddler) met criteria b and c, but were not yet applied to support teacher self-reflection. (Note that these and other annotation tools may subsequently be applied to support teacher reflection.) Due to new research on recent uses of StudioCode in teacher education, we decided to include it in this review.

As summarized in Table 1, seven video annotation tools met the criteria for inclusion: the VAST, VITAL, the VAT, VideoTraces, Video Paper, MediaNotes, and StudioCode.

Table 1

<table>
<thead>
<tr>
<th>Video Annotation Tool</th>
<th>Delivery Mode</th>
<th>Annotation Style</th>
<th>Collaboration</th>
<th>Related Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAST (next version to be called “Video Callout”)</td>
<td>Stand-alone application</td>
<td>Users select portions of video and associate text with them. Scaffolded writing areas are provided</td>
<td>No collaboration tools are built into system</td>
<td>Lesson Resources identifies related data</td>
</tr>
<tr>
<td>VITAL (recently underwent redevelopment)</td>
<td>Web based</td>
<td>Users create video clips and reference them as hyperlinks into a typed paper</td>
<td>No collaboration tools are built into system</td>
<td>No ability to connect to other data sources</td>
</tr>
<tr>
<td>VAT 2.0 currently under development</td>
<td>Web based</td>
<td>Users select portions of video and associate comments with them. Users can also associate clips with a portion of a rubric</td>
<td>Others can annotate a video, share annotations, and view up to two annotated videos simultaneously</td>
<td>No ability to link to other data sources</td>
</tr>
<tr>
<td>Video traces</td>
<td>Stand-alone application</td>
<td>Users select portions of video and narrate with spoken comments. Using a pointer, the user can visually highlight portions of video</td>
<td>Different users can create annotations on same video; users can respond to annotations, creating a “threaded discussion.”</td>
<td>No ability to link to other data sources</td>
</tr>
<tr>
<td>VideoPaper</td>
<td>Stand-alone application; export to Web</td>
<td>User selects portion of video and associates with text. A hyperlink is created to play the designated portion of video; captioning allows the creation of a timed transcript</td>
<td>No collaboration tools are built into system</td>
<td>Ability to hyperlink to other text-based sources. Video portions may be synchronized with images</td>
</tr>
<tr>
<td>MediaNotes (Prior version named “The Performance Analyst”)</td>
<td>Stand-alone application</td>
<td>User selects beginning and endpoints on video, titles, comments, and associates clips with a predetermined framework</td>
<td>Multiple users may edit a single video. Advanced searching capabilities may be used to find themes within and across videos</td>
<td>No ability to connect to other data sources</td>
</tr>
<tr>
<td>StudioCode</td>
<td>Stand-alone application</td>
<td>Users create and apply a set of codes to selected portions of the video</td>
<td>Several users can annotate the same file and share their annotation files for comparative review</td>
<td>No ability to link to other data sources</td>
</tr>
</tbody>
</table>

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As summarized in Table 1, seven video annotation tools met the criteria for inclusion: the VAST, VITAL, the VAT, VideoTraces, Video Paper, MediaNotes, and StudioCode.

VAST (http://www.professional-vision.org/)

VAST (Figure 1), developed at Northwestern University, has been used in mathematics and science teacher education programs (van Es & Sherin, 2002) as well as with inservice teachers (Sherin & van Es, 2005). Using VAST, teachers captured specific video segments that researchers uploaded and transcribed for subsequent analysis (see label A). VAST scaffolds analysis through “guided noticing” writing panes and tabs sequenced to encourage analytic thinking about pedagogy from different perspectives (see label B). Teachers were initially asked, “What do you notice?” to provide evidence of and to interpret the evidence. They then were encouraged to pose questions about what they noticed or how they would respond during instruction, which could be explored further using the framework of Student Thinking, Teacher’s Roles, and Discourse (see label C). VAST allows other related nonvideo resources (e.g., student work, lesson plans, etc.) to be displayed while analyzing a video (see label D), which researchers also uploaded prior to teacher or group reflection.
van Es and Sherin (2002) studied how a group of teachers enrolled in an alternative certification program used VAST to analyze practices during their teaching internship. Six of the 12 participants were randomly chosen to write their internship analyses before, during, and after their teaching session using VAST; the remaining teachers reflected without VAST. Researchers reported that participants who used VAST were more likely to improve analyses of their practices than non-VAST candidates. Furthermore, VAST users provided more specific evidence for their arguments than non-VAST users did. The ability to both meaningfully analyze practice and to provide clear evidence for reasoning may improve these teachers’ ability to make informed instructional decisions in the future.

More recently, Sherin and van Es (2006) used VAST in a series of studies involving inservice teachers’ video clubs. In video clubs, teachers use recorded and transcribed videos once or twice each month throughout the course of the school year to study their teaching and student thinking. Teachers initially focused on teacher-centric actions but gradually move toward examining and initiating inquiry about student thinking. Thus, in this case, the tool enabled teachers to reflect on how their practices influenced student learning.

VITAL (http://vital.ccnm.tcolumbia.edu)

Columbia University’s Center for New Media Teaching and Learning initially developed VITAL (Figure 2) to train students (student teachers, psychology students, etc.) how to observe children closely and interpret their behavior; it has since been used across a range of courses and disciplines. Like VAST, VITAL allows users to create, annotate, and store video clips in a personal library; unlike VAST, VITAL is designed to encourage thinking through essays that are based on events depicted in their video library. Viewers create anchors or place holders and annotate specific video sections that serve as video hyperlink reference points to their VITAL essay (see label A). Teachers then embed hyperlinks within their essays to the anchored video clips as they associate their descriptive analysis with specific captured events. VITAL scaffolds teachers’ analyses using a guided thinking process to Observe, Think, Interpret, Ask, Transfer, and Reflect (Preston, Campbell, Ginsberg, Sommer, & Moretti, 2005).

Mathematics educators have used VITAL to guide preservice teachers’ analyses of personal teaching practices (Preston et al., 2005). Once per week for 9 weeks, teacher education candidates analyzed and annotated project video of elementary students solving math problems, then synthesized their analyses into a VITAL essay with associated video hyperlinks. Similar to Sherin and van Es’s (2006) approach, VITAL researchers encouraged participants to analyze student thinking through scaffolded video analysis. At the end of 9 weeks, preservice teachers extended and personalized their multimedia essays by analyzing videos of their own teaching.
They designed and implemented a learning activity based on children’s mathematical abilities, documented the experience by capturing original video, and reflected on the way their practices affected student learning in their VITAL essays. Participants reported that VITAL helped them to better connect theory with their own practice—a particularly challenging task for preservice teachers (Maloch et al., 2003).

**VAT (http://vat.uga.edu)**

VAT (Figure 3), a Web-based system that enables teachers to upload, archive, segment, annotate, and share videos was developed at the University of Georgia and has been used in social studies, science, and elementary education courses. The system uses the notion of "lenses," frameworks that amplify or suppress specific aspects of teacher practice or student learning, to focus and guide analysis (marker A). VAT provides the option to use several frameworks to interpret a single video, ranging from standards-based teaching practices from national organizations to perspectives on classroom management, to examine the same captured events from different perspectives (see label B). VAT enables comparisons between assessors of identical video(s); with permission, a peer, teacher educator or supervisor can also access and annotate the captured events, and users may share video clips and comments with the approval of the video owner. A teacher can then view multiple annotated videos individually or side by side, as well as collaboratively using identical or complementary video of the same events (e.g., teacher’s perspective compared with mentor teacher’s perspective).

In a sequence of studies, VAT helped preservice teachers to identify and confront contradictions between and among their beliefs and practices. Bryan and Recesso (2006) studied how student teachers analyzed their beliefs about science. Seven secondary science education student teachers wrote personal belief statements about how students learn science, the role of the teacher in this process, and the role of the learner. Twice during the semester, participants recorded themselves teaching and used a science inquiry framework to identify resonance or dissonance between their belief statements and their actual teaching practices. The authors found that the VAT helped student teachers identify aspects of their practice that were aligned with their beliefs as well as confront possible contradictions in their teaching.

More recently, Rich, Recesso, Allexsaht-Snider, and Hannafin (2007) studied the approaches of 27 preservice elementary education teachers as they confirmed or challenged the alignment between their teaching beliefs and practices during a month-long field experience. Each participant examined a series of published articles on an aspect of teaching practice of specific interest and then...
created a corresponding lens to later analyze their own teaching. Similar to Bryan and Recesso’s (2006) findings, preservice teachers identified discrepancies between their perceived experiences and their video-captured teaching practices (Rich & Hannafin, in press). Based on contradictions, participants documented positive change in their intentions and resultant instructional decisions. Thus, in both cases, VAT scaffold reflection helped prospective teachers to confirm or challenge the alignment between teaching beliefs and practices.

**Video Traces (http://depts.washington.edu/pettt/projects/videotraces.html)**

Reed Stevens (University of Washington) originally created Video Traces to help museum visitors reflect and collectively comment on otherwise ephemeral experiences at exhibits. The Video Traces (Figure 4) software enables users to annotate voice, point to, and draw “common objects” such as still images and audio-video files (Saxena & Stevens, 2007), thus annotating video with “traces.” A trace thread documents the sequence of initial and subsequent response traces. The program enables teachers to view and annotate based on individual goals and needs. To support reflection, for example, Video Traces enables multiple teachers to view and comment using talking (see label A), pointing (see label B), and drawing tools on the same student worksheet or video clip of a teaching episode. Using the “Respond to trace” feature, teachers can review and respond to each other’s traces, thus generating a threaded discussion around the common object. The Video Traces medium stores individual commentator annotations, which can be shared among and accessed by others in the group.

Video Traces has been studied as a tool for providing or receiving feedback from a student teacher’s cooperating teacher, clinical supervisor, and university faculty (Miller & Carney, 2007), creating an asynchronous conversation among parties around a single teaching event (Stevens, 2007). During a semester-long student teaching experience, three elementary education student teachers video-recorded themselves while teaching two different lessons. Using a statewide teacher assessment tool designed to measure the effectiveness of teaching, two clinical supervisors, two education faculty members, and three cooperating teachers then provided verbal and gestural feedback on different aspects of the lesson. In addition, the three students used Video Traces to analyze their own teaching. Researchers reported that although Video Traces helped to facilitate student teachers’ reflection, raters’ analyses using a state-adopted teacher candidate assessment instrument varied...
significantly. Thus, Video Traces aided preservice teachers in reflecting on their instructional decisions but raised reliability concerns when used for external assessment by different stakeholders.

**VideoPaper (http://vpb.concord.org/)**

Developed in 2000, VideoPaper was funded by National Science Foundation as part of the *Bridging Research & Practice* project at Technical Education Research Centers. VideoPaper (Figure 5) has been used in a number of national and international settings, with focus ranging from mathematics to teacher education. VideoPaper allows users to associate comments as well as images (see label A) to a specific portion of video. Recent versions support captioning (see label B)—providing a synchronized written transcript or other written elaboration—while video is displayed. The user can toggle between video and text comments in real time by selecting the corresponding links. VideoPaper also allows the linking of images to specific locations in a video segment, such as a video depicting a preservice teacher helping a student with classwork accompanied by images of the student working on the problem. Similar to VITAL, users create and subsequently embed hyperlinks (see label C); when clicked, these links skip to and play a specific portion of video.

VideoPaper has been used at Tufts University to promote self-reflection. In one study (Beardsley, Cogan-Drew, & Olivero, 2007), teacher educators used the “wild triangle” method (McDonald, 1992), an approach that emphasizes the interplay among the teacher, subject, and students, to help preservice teachers focus on a specific aspect of their teaching. Prior to annotating, candidates watched their own video in its entirety and then identified unexpected or puzzling aspects of the wild triangle in their videos. To engender depth of analysis over breadth of representation, researchers encouraged participants to select a few “surprise” instances for detailed analysis, focusing specifically on teacher, subject matter, and student. Faculty reported that by emphasizing the level of contemplation or analysis provided by using VideoPaper over evidence that preservice teachers themselves identified, they were better able to reflect about their classrooms practices. This, in turn, increased the specificity of communication between teacher educators and preservice teachers.
MediaNotes (http://www.bluemangolearning.com/products/medianotes)

MediaNotes (Figure 6) was originally developed as “The Performance Analyst” at Brigham Young University for use by law school and dance students, but has since been used by faculty and students in business, engineering (Wright, 2008), statistics, and teacher education (Tripp, 2008). Teachers can create annotations by naming (see label A), segmenting (see label B), commenting (see label C), and tagging (see label D) a given video segment. Tags are predefined codes associated with specific video clips. Much like the VAT, codes serve as a lens or framework to guide analysis. Using meta-data tags, MediaNotes allows the same or different authors to code the identical video multiple times. Whereas the previous tools provide annotation options, MediaNotes supports complex data mining of these annotations. Teachers can identify patterns within a single video or across an entire video library by sorting and filtering, enabling analysis across time, space, tag set (i.e., framework), or person.

According to Wright (2008), MediaNotes was recently used in a partnership between local schools and Brigham Young University. Six induction teachers (a) met with their mentors to discuss the purpose of teacher observation and evaluation, (b) chose a goal that was based on available teaching standards, (c) video-recorded themselves while teaching, (d) analyzed video of their teaching using a specific framework (i.e., “tag set”), (e) collaborated with their mentors, and (f) set goals for future teaching. Induction teachers then again met with and presented their cases to the mentor teacher, who acted as a professional guide and, through dialog, jointly negotiated goal(s) for future teaching. The entire process was then repeated. Induction teachers reported that they gained self-understanding, which helped them to better understand what they should be doing to be effective teachers (Wright, 2008). Importantly, initially reluctant administrators reported that MediaNotes increased the meaning of teacher evaluation by clarifying the focus of assessment as a formative process.

StudioCode(http://www.studiocodegroup.com/)

StudioCode (Figure 7), originally developed as a tool to code video of sporting events, has since been used in
teacher education, medicine, science, speech pathology, and mathematics. To annotate video, a user creates codes and code sets. Separate codes then appear as buttons (or shortcut keys) that can be applied to specific video segments (see label A). Studiocode also supports the ability to synchronize a closed caption transcript of the video (like VideoPaper), write directly on the video (like VideoTraces), and allow multiple users to code or comment a single video (like VideoTraces and MediaNotes). Studiocode is uniquely powerful for mining coded video segments using Boolean searches. For example, if interested in identifying all instances in which female students were called on during class, one could search transcripts for the codes “calling on students” and “girls.” These associated video clips could then be arranged in a chapter and exported as a single movie file for simplified use. In addition, Studiocode provides simple quantitative analysis (i.e., count matrices; see marker B) for codes and transcripts, which can be exported for detailed data analysis.

Researchers at The Pennsylvania State University and Brigham Young University have applied StudioCode in science education and physical education programs, respectively. In a recent study, elementary teacher education candidates used StudioCode to learn how to observe specific teaching behaviors (Dye, 2007). Candidates first observed a video of an inservice teacher during a lesson and coded specific instances of five different teaching behaviors. Two expert teachers coded the same video and compared the number and length of their own codes to those of the candidates. After achieving > 80% agreement with the expert coders, candidates were then recorded during their own teaching. Each then used StudioCode to segment and code the video and submitted their best evidence of a specific teaching behavior for comparison and review. Results indicate that, within roughly 2 hours of training and practice, novice teachers attained moderate to high reliability with expert coders’ ratings—important where accountability for documenting standards-based teaching practices has become paramount.

**Affordances and Challenges**

Given the emergent nature of video annotation technology, new features and capabilities continue to be developed and refined. In the following section, we compare and contrast the affordances of the video annotation tools reviewed to identify how they have helped—and might potentially—teachers reflect on their practices drawing on research to demonstrate how these tools may further influence teacher education practices. We also identify limitations in annotation technologies and areas of needed research.
Connecting Evidence

Although video provides observable evidence of a teacher’s instructional decisions, it is necessary to connect “captured practice” to teacher intents and related evidence. Typically, these systems connect textual annotations of teacher thoughts to specific sections of video. Video annotation enables preservice teachers to connect hitherto tacit assumptions to independent evidence of their practices without inherently prioritizing one over the other. According to Preston et al. (2005), 73% of preservice teachers reported that simply knowing that video clips would be used as evidence of thinking in their VITAL essays influenced how they watched videos. Video Traces extends the range of evidence to include aural and gestural events that permit users to consider synchronized feedback at precise points in their practice. Video Paper synchronizes the appearance of images (e.g., student work) within the video timeline. Researchers who encourage written reflections of video self-analysis (Collins, Cook-Cottone, Robinson, & Sullivan, 2004; Halter, 2006; Jensen, Shepston, Connor, & Killmer, 1994; Sherin & van Es, 2005; Stadler, 2006) report that teachers who record reflections after viewing video of their teaching demonstrate more accurate perceptions of their abilities than those who do not. Thus, the ability to annotate a video easily becomes critical as educators seek accurate representations of teaching practice.

Borko, Cone, Russo, and Shavelson’s (1979) study of instructional decision making demonstrated that teachers’ decisions were often affected by several, seemingly contradictory sources of information. That is, multiple inputs were needed to adequately reflect the underlying complexity of instructional decision making. VAST offers a portfolio-like connection to external resources, such as lesson plans, student work samples, and other documents that can be digitized. Video Paper provides a time-synchronized connection between documents, and MediaNotes and StudioCode allow advanced data mining across different videos. The capability to demonstrate connections among multiple sources of evidence may help preservice teachers to understand and explain how “authorities, time, students, and resources occur simultaneously” (Lampert, 2001, p. 1) to affect instructional decisions.

Analytical Frameworks

Zeichner and Tabachnick (1991) underscored the importance of analytical frameworks to scaffold and structure reflection:

... we do not think that it makes much sense to encourage or to assess reflective practice in general without establishing clear priorities for the reflections [emphasis added] that emerge out of a reasoned educational and social philosophy. (p. 2)

According to Sherin and van Es (2005), video annotation tools can direct analysis, implicitly or explicitly, using an appropriate lens or framework to guide interpretation—
a position shared by the majority of video reflection researchers (see, e.g., Byra, 1996; Collins et al., 2004; Grainger, 2004; Griswold, 2004; Halter, 2006; Jensen et al., 1994; Miyata, 2002; Pailliotet, 1995; Powell, 2005; Preston et al., 2005; Sharpe et al., 2003, Struyk & McCoy, 1993; Thomson, 1992; van Es & Sherin, 2002; Warden, 2004). Initial efforts showed mixed success in having teachers or teacher educators consistently apply such frameworks to analyze practice, but Dye’s (2007) work with preservice elementary education teachers demonstrated that teachers learn to reliably code StudioCode video in a relatively short amount of time.

Although differences are apparent, tools share similar functions for creating and using analytic frameworks. VAST, VAT, and MediaNotes scaffold teachers’ attention to specific aspects of practice; each tool involves the use of a specific framework to analyze practices. VITAL researchers recognized the importance of a specific method for analyzing and synthesizing video evidence, which has been refined through successive implementations of the software. VITAL researchers now encourage teacher candidates to observe, think, interpret, ask, transfer, and reflect (Preston et al., 2005).

VAT uses the metaphor of a “lens” through which specific practices are highlighted for detailed inspection as teachers identify a focus for an inquiry, collect evidence around that focus, interpret the collected evidence, and propose and enact a course of action—a process similar to how MediaNotes is used at Brigham Young University. Video Traces has been used to guide mentor and student teacher “noticing” to the structures associated with a statewide teacher assessment tool. Teacher educators using VideoPaper have employed the “wild triangle” approach, focusing on the teacher, students, and curriculum, and encourage preservice teachers to identify a particular aspect of teaching they wish to investigate prior to video-recording. MediaNotes and StudioCode allow teachers to select and apply ad hoc frameworks and to search for patterns among selected codes. In each case, the analytical task is guided, in some case structured, to permit reflection on specific practices deemed important.

Collaboration

Collaboration is critical to reflecting on one’s own practice (Halter, 2006). This may be because “individuals tend to regard themselves as proficient, and honest/objective evaluation is difficult” (Barber, p. 226). In studies where participants reflected both in writing and in collaborative discussion, participants reported the greatest benefit from discussing their teaching with others (Byra, 1996; Griswold, 2004). In Sharpe et al. (2003) and Sherin and van Es (2005), teachers reflected with their peers. Others report these experiences to be most positive because they reflected with their supervisors (Thomson, 1992). Grainger (2004) concluded that allowing teachers to view and discuss their teaching was the best way to access knowledge about what influenced the teachers’ actions.

Although each tool reviewed enables teachers to share annotated video evidence, four have features specifically designed to facilitate collaborative analysis. VAT provides multiwindow viewing panes, which allow teachers to share videos with peers, mentors, supervisors, and teacher educators (Figure 8). This feature has allowed teacher educators and mentor teachers to independently analyze a preservice teacher’s video, then exchange perspectives and interpretations related to instructional decisions (Rich & Hannafin, 2008a). MediaNotes also allows independent video annotation but permits users to search across collaborators, making independent analysis possible and facilitating collaborative review and pattern finding. Video Traces uses a dialogic collaboration in which several users can edit and comment on a single video, with responses threaded around a specific set of actions. Through collaborative reflection, teachers receive the objective evaluation Barber (1990) advocates and the ability to align evaluative purposes and goals (Wright, 2008). Finally, StudioCode provides a text file of codes with which to generate a coding matrix (Figure 7, label B) wherein teachers can compare the number and length of their independent assessments.

Technical Effort

Prior studies demonstrate that the amount of effort required to reflect on captured video influences both the processes and outcomes of reflection. This effort may contribute or detract from reflection goals and processes. Video editing has been described as a time-intensive and training-intensive activity (Collins et al., 2004; Cunningham & Bendetto, 2002; Dias, Calandra, & Fox, 2007; Nicol & Crespo, 2004; Spurgeon & Bowen, 2002; Preston et al., 2005; Warden, 2004). Importantly, the time needed to train teachers how to edit video often detracts from time needed to critically reflect. Paradoxically, others have underscored the importance of editing, focusing, and structuring reflection precisely around those teacher practices (e.g., Calandra, Gurvitch, & Lund, 2008; Rosaen, Lundeberg, Cooper, Fritzen, & Terpstra, 2008).
In response, video annotation tools attempt to redirect effort to specific teaching activities or events, thereby increasing opportunities to reflect and focus on practice more readily than conventional video technology. Some tools still may require that teachers learn to upload captured video prior to having the opportunity to annotate and reflect on captured practices. VAST and VITAL, for example, require that teachers wait until researchers upload (and transcribe for VAST) individual videos before they become available for review. With VideoPaper and VideoTraces, teachers must first edit their videos using an external editor before becoming available, which can delay analysis of their practices. Although video editing is not required due to the postannotation export features, MediaNotes, StudioCode, and VAT require that teachers first convert their videos to a compatible format (e.g., .mov, .wmv) before they can be accessed and analyzed. This effort, although it enables detailed scrutiny and is necessary to use the tools, does not directly facilitate critical reflection.

Two systems allow simultaneous, real-time annotation and recording. Using StudioCode, teachers may connect a camera to their computer via a USB cable and a peer or collaborator can annotate video while recording. StudioCode also allows teachers to create shortcut keys for specific codes, enabling observers to annotate video in real time. VAT also provides the option for a collaborator to annotate video in real time by streaming captured video. VAT’s distributed, Web-based nature enables educators to annotate during or immediately following recording, regardless of geographic location. Limiting time lags between video capture and analysis may become especially important to support teachers’ reflections: the longer the time (and more effort) required to initiate analysis, the longer (and potentially less likely) a teacher will use the system to analyze and reflect on practice.

With the exception of VAT and VITAL, the tools reviewed are computer based; some researchers have cited access as potentially limiting the tool’s utility (Cherry, Fournier, & Stevens, 2003). In such cases, collaboration may become difficult as colleagues and mentors must share access to a single computer. VAT and VITAL differ in that they are Web-based tools that can access and share video files and assessments wherever Internet access is available. Teachers can access video files independently or collaboratively, and annotations can be simultaneously accessed by numerous users—a feature mathematics education students reported as being particularly valuable (Preston, 2004).

Implications

To date, evidence suggests that video annotation tools can augment and extend teacher reflection experiences by facilitating and structuring the analysis process. Teachers can share common frameworks to analyze each others’ teaching,
providing a richer range of perspectives on individual practices. Erstwhile, tacit teacher reasoning and processes can be made explicit to the individual and visible to others (Beardsley et al., 2007). Finally, teachers have become sensitized to the influence of their practices on student thinking (Preston et al., 2005; Sherin & van Es, 2007).

However, although teachers have used video to augment reflection for at least 20 years, the advent of video annotation tools in teacher education is relatively recent; both new tools and supporting evidence are only beginning to emerge. There exist several unanswered questions regarding their practicality and implementation and several long-standing concerns related to video and reflection remain. Although we cannot address all concerns, several are key to defining the future of video annotation tools in teacher education.

Where is the Rigor?

Researchers have just begun to examine the effects of video annotation tools on teacher practice or student learning. Much like reflection literature, the few studies of tool-assisted reflection on teacher practice have proven equivocal—often appearing only in conference presentations, software materials, and Web sites. Few researchers have documented research findings in peer-reviewed journals. In introductory commentary to an edited volume on the use of video in teacher education, Brophy (2004) noted similar concerns over the lack of core scholarship dedicated to using video in teacher education: “much of the research on video in teacher education has been limited to studies of relatively global perceptions of its value” (pp. x-xi). Both video and reflection literature tend to be strong on ideas but lack evidence of impact.

What Costs Are Associated With the Use of Video Annotation Tools?

Users vary widely in their reports of video annotation tools’ utility, usability, and value. Shepherd and Hannafin (2008), for example, reported significant resistance from teacher education faculty, preservice teachers, and cooperating teachers to using VAT to analyze practices for student–teacher portfolios. Much of the concern was related to the time required and the need to adapt to a new system (given ongoing commitments), others recognized value but continued to resist, and still others simply viewed the analysis of teaching practice as unimportant. The transition to technologically based systems will involve considerable changes in routine and approach among educators already familiar and comfortable with traditional approaches.

What Risks Are Associated With Video Annotation Tools?

Perhaps the most significant hurdle lies in the myriad legal and ethical issues associated with capturing and analyzing teacher practice. For example, can video captured to support self-analysis be co-opted for different purposes such as supervisor evaluation? Who owns annotated video and can access and use the information? For what purposes? Because students as well as other educators may well be captured, how is their identity safeguarded? In Web-based systems, streaming video and data ensure ready dissemination, but how will the information be protected? These questions have been addressed by several of the tool developers featured, but standards for use and protection will need to be established to promote widespread use.

Which Evidence—Video and Nonvideo—Supports Teacher Reflection?

Although some annotation tools allow and even solicit nonvideo evidence, little nonvideo evidence was presented documenting how such evidence is weighed or which evidence has the greatest force for promoting reflection. Cochran-Smith (2006) suggested that “evidence” has become the new buzz-word in teacher education; Davies (1999) noted, “there is no such thing as context-free evidence” (p. 110). To some extent, video annotation tools may help to situate teaching activity by capturing practice in context and relating these with associated evidence of student learning; but which evidence will best support reflection?

Conclusion

Although we have emphasized support for reflection, video annotation tools have been used to address a wide range of teacher preparation and development concerns, including board certification, e-portfolios, detection of active student engagement, and teacher and administrator assessment and evaluation. Clearly, the potential for broad application is significant, and in an era of accountability, both the general public and education communities will likely expect or demand that we become increasingly sophisticated in how we implement and assess our practices. To address these expectations, nascent technological developments such as video annotation tools provide core capabilities that will undoubtedly continue to grow in scope and refine in sophistication and ease of use. The tools reviewed remain under development and are not panaceas;

Interesting...
they do, however, portend important changes in both the nature and sophistication of the education enterprise.

Since the work of John Dewey, teacher educators have sought to balance formal and informal experiences with the ideals and the realities of teaching in schools, physical distance, and the need to safely and effectively immerse preservice teachers in the culture of schools and the teaching profession. As technologies extend our ability to access authentic teaching opportunities, preservice teachers can engage in, participate in, and provide a transition toward everyday classroom teaching. Video annotation tools offer teachers the ability to see, as well as to analyze and refine, practice prior to, during, and following formative field experience.

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