Examining student thinking through video analysis

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Introduction

For preservice teachers, videos of children interacting with other children or with teachers can serve as more than a repository of "virtual kids." An inquiry-based approach to watching such video, supported by tools that allow for frequent and close viewing, provides an opportunity for prospective teachers to develop their skills of observation and interpretation before entering the classroom. Furthermore, the in-depth study of videos—particularly if the videos capture situations that reveal something about children's thinking—creates a context in which teachers can act as researchers by gathering evidence, developing hypotheses, and coordinating this information as a guide for further inquiry and teaching. Over time, close and repeated viewing and analysis of video helps shift focus away from the teacher and to the child, and allows for a richer conception of the relationship between children's performance and understanding, to help better inform teaching.

Research suggests that a "cognitively rich environment" can aid in the development of the skills of observation, interpretation and argument (Kuhn, 2001a; Kuhn, Shaw, & Felton, 1997). To support teachers' learning about children's thinking, and to help teachers develop these skills, the Columbia Center for New Media Teaching and Learning (CCNMTL) and Prof. Herbert Ginsburg of Teachers College, Columbia University, created a web-based video analysis system called VITAL, or "Video

Interactions for Teaching and Learning." The VITAL software is a course management system with tools for enabling students to view, analyze, and write about video.

The work preservice teachers perform in VITAL has a number of potential implications for teacher development: first, it grounds learning in the empirical, and second, it offers the opportunity to practice skills of observation, interpretation, and reasoning in preparation for entering the classroom. The immediate goal of the VITAL method is to help preservice teachers (or students from any discipline) become more likely to gather their own evidence of understanding and to encourage them, through repeated viewing and manual interaction with the video content, to be deliberate in validating what they see and in explaining the connections between their evidence and claims about learning. A long-range goal of the method is to help teachers develop a more conditional notion of "the truth" that encourages them to entertain alternative hypotheses and promotes further inquiry and new ideas for teaching. This process represents a recursive, iterative response to new events; gathering more information creates the need for new evidence. By practicing these activities in a controlled setting, teachers can then prepare for classroom-based formative assessment.

VITAL: A system for video analysis and interpretation

The VITAL system comprises two main features: a video viewer with tools for bookmarking and writing notes about video clips, and a workspace where users can compose "multimedia essays" in which video clips can be integrated with text and cited as evidence to support a hypothesis. A course "home" page in VITAL looks like a conventional syllabus, with a list of topics, readings, and assignments, but it also includes

a selection of videos for each topic that can be viewed by clicking on the links embedded in the page. (See Fig. 1.) A course in VITAL can include any quantity of video, although typically instructors will construct a syllabus with a small number of required videos and a larger number of supplementary or optional videos.
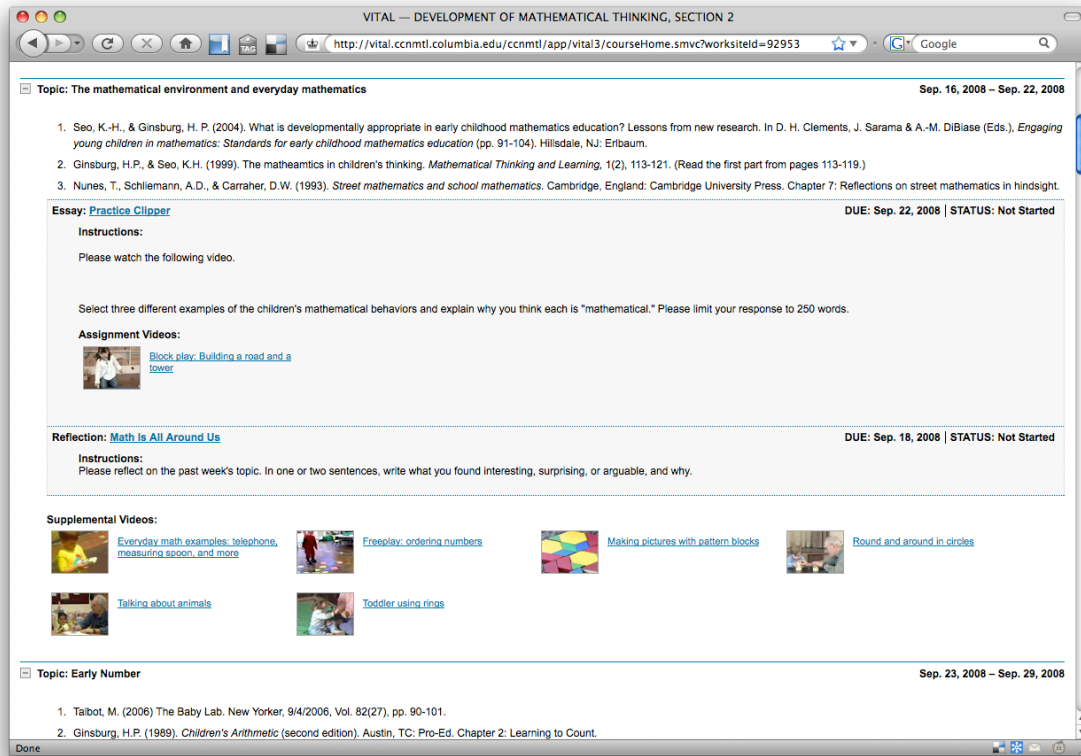

Fig. 1: A single week's topic from the syllabus in VITAL, including an assignment with one required video, followed by six recommended videos.

VITAL also offers several features that enable students to work with video at home via the web. The first is a "video viewer" in which students can select and clip their own segments from the videos, and attach a note to each clip to help them remember the significance of the content. (See Fig. 2.) These clips and notes are saved in a personal workspace, where they can be accessed later and used to support an essay.
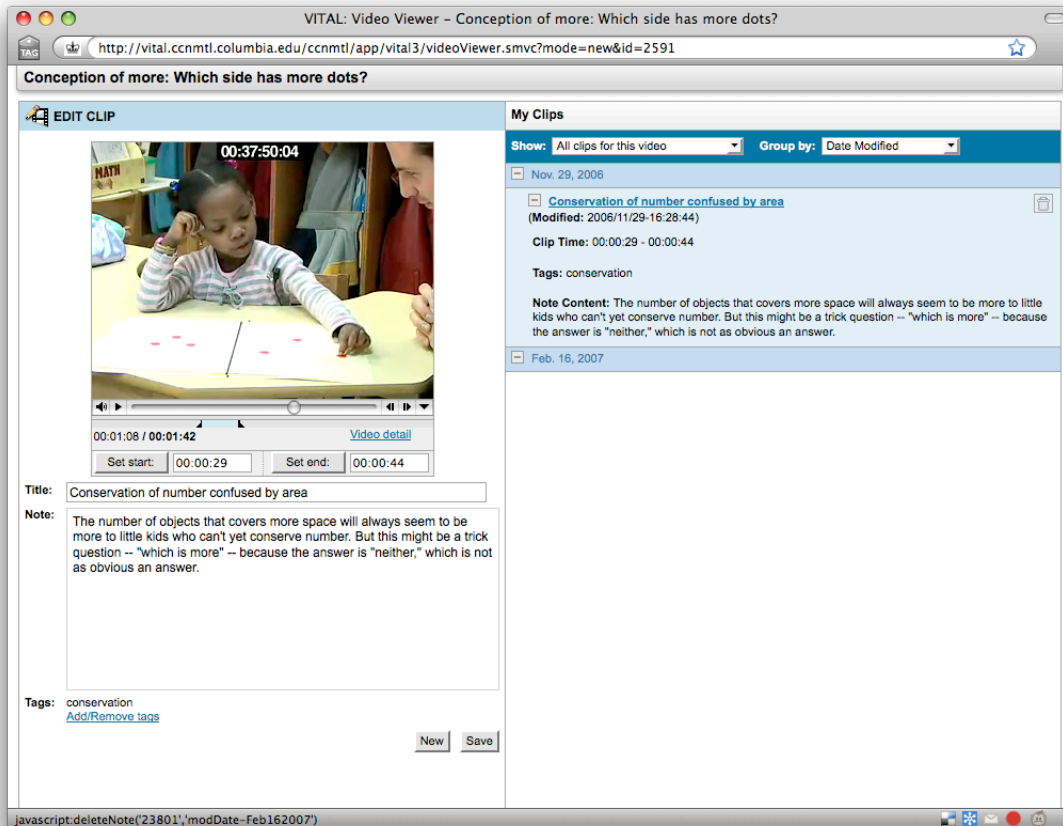
Fig. 2: The VITAL video viewer, with editing tools and an annotation space beneath the video, and clips with notes collected in the right-hand column.

The second feature is a "multimedia essay" workspace where students can integrate their clips with text. (See Fig. 3.) For example, in Prof. Ginsburg's course on early childhood mathematics education, students are asked to write essays of 350 words or fewer in response to questions such as, "What do the children know about number? Please cite from the videos and the readings." These assignments encourage students to develop their own hypotheses and select evidence from the text-based and video course materials that support their argument. Completed essays are "published" within the VITAL environment to be read by the instructor and other students. The instructor can also leave feedback for the student.
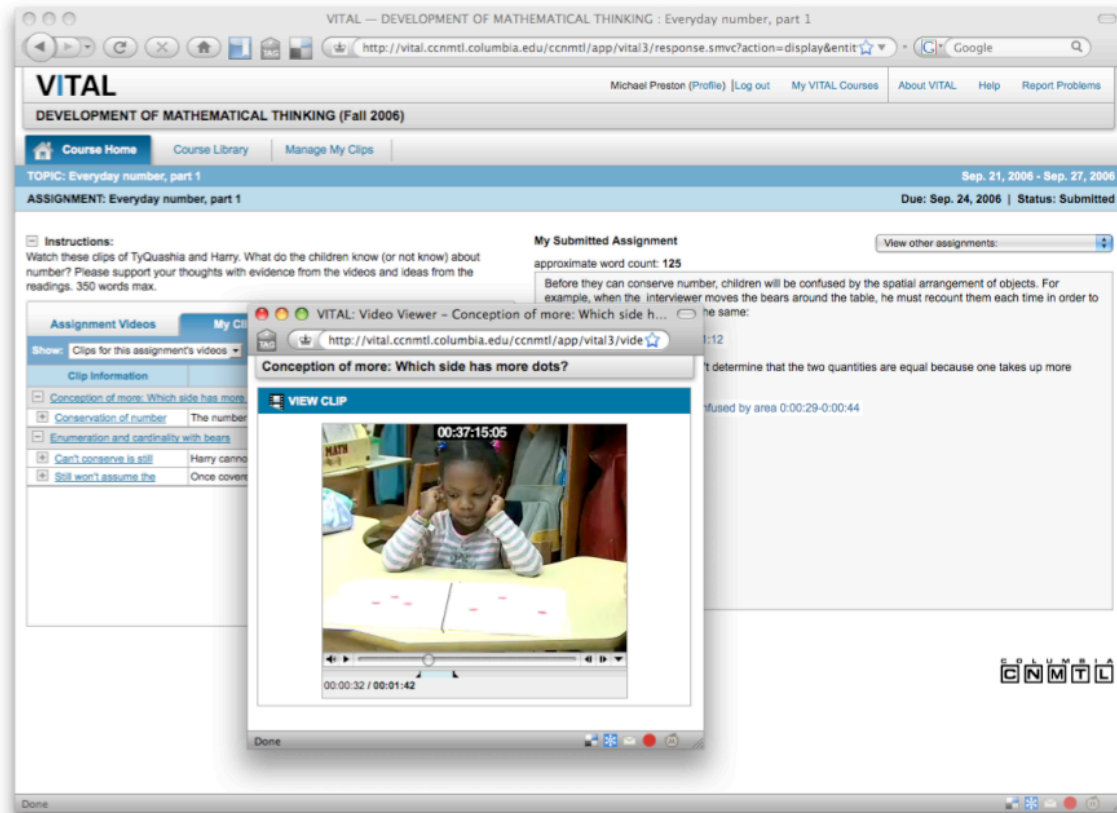
Fig. 3: The multimedia essay, with the student's collected video clips on the left side of the screen, and a writing space incorporating text and video on the right. Students click or drag their video clips to add them to their essay.

In addition to multimedia essays, VITAL supports a "guided lesson" format in which instructors preselect video clips and organize them to be viewed in a specific sequence by students, who must answer questions associated with each video segment. Guided lessons are most successfully used for teaching skills such as clinical interviewing, by simulating the process of responding to a child's behavior with an interpretation, a new question, or even a critique of the interviewer's technique in the video.

Students can contribute their own videos to VITAL, as well. For example, in the final month of his early childhood mathematics course, course, Prof. Ginsburg's students

complete an integrative project that involves designing and videotaping a mathematical activity and clinical interview with a child to assess what he or she learned. The final project report submitted in VITAL, a multimedia essay incorporating clips from their videos, serves as a demonstration of the students' ability to think critically—even scientifically, by adopting a more experimental approach to formative assessment—about the work they are doing as teachers, and what a child might be learning as a result.

Assessing teachers' thinking about children's thinking

How do we know that the various elements of a VITAL course support critical thinking skills? An exploratory study (Preston, 2008) led to the development of categories of critical thinking that can be applied to students' written work in VITAL. These categories — claims, evidence, "relational statements," and modest statements — combine to represent a working definition of informal argument, consisting of a central claim and supporting evidence, and relational statements that explicitly coordinate claims and evidence (Billig, 1987; Kuhn, 1991; Glassner, 2005). More robust arguments also account for competing claims (Finocchiaro, 2003; Glassner & Schwarz, 2005) and thus exhibit a kind of "modesty," as do efforts to identify needed evidence and suggestions of methods for obtaining it. Additionally, an important characteristic of high-quality arguments is parsimony; offering the "minimum interpretation possible" demonstrates a respect for evidence and epistemological uncertainty. To make additional claims, one may have to gather more evidence.

Using these categories, three independent reviewers analyzed a series of three multimedia essays (beginning of the course middle, end) written by a randomly selected

sample of 20 preservice early childhood teachers in Prof. Ginsburg's course. The students were not aware of any research interest in these criteria, nor were they instructed explicitly in the skills of argument. The instructions for each essay focused primarily on the relevant content, although they did encourage students to cite evidence, as noted earlier.

The categories were defined to the reviewers as follows:

1. A *claim* is a generalization, a statement of belief, or an assertion (about children, learning, etc.). It can also be a prediction. A claim tends to introduce a new idea, e.g., "Children can count mentally or use a variety of other strategies." A claim tends to be broad and to require substantiation, e.g., "The boys demonstrate a strong understanding of spatial relations."

2. *Evidence* is a reference to or description of observable events, usually positioned after a claim. In this study, evidence can appear as text (verbal description) or video inserted within the essay. Evidence contains observable events that two people can more or less agree upon objectively, e.g., "Armando tries to add another block to connect the two structures, but it doesn't reach." Evidence can include both verbal and nonverbal behaviors, e.g., "Armando begins looking around for a certain block and says 'circle thing' to describe it." There is an interpretive component in the naming and placement of a clip, but any deliberate attempt to use evidence to support a claim constitutes a "relational statement" (see below). Evidence refers exclusively to the naming or identifying of observable behaviors.

3. A *relational statement* offers an explanation/interpretation of how the selected evidence connects back to a claim. A relation interprets what is happening in the cited evidence, e.g., "Armando's use of the phrase 'circle thing' demonstrates that he knows some shapes and can identify this aspect of the cylinder, even if he doesn't have the proper word for it." A relation explains how the evidence supports (or contradicts) a claim, e.g., "Gabriella appears to know what colors can be used in her blue-green pattern, but when she chooses yellow, it shows that she may be more focused on the colors than on the rules of patterns." Relational keywords include "shows" and "demonstrates," i.e., words the author uses to explain the evidence or to comment on something that is otherwise observational. Good relational writing might include more than one interpretation per piece of evidence.

4. *Modest statements* evaluate the adequacy of a claim, propose alternatives, or acknowledge the limits of the evidence. Modesty includes "intellectual humility" by which the author recognizes the limits of what is knowable given the evidence, e.g., "At this point it seems that the child understands the idea of pattern." Modest language includes explicit statements in which the author assesses the relative certainty of a specific interpretation, e.g., conditional words like "might" and "could" (anticipating other possible interpretations), perception words like "appears" and "seems" (limiting certainty), temporal words like "now" and "before" (acknowledging interpretations can change with new evidence), and metacognitive words like "we realize" and "leads one to believe" (inserting the author's thinking into the essay). Modesty can also identify missing evidence,

e.g., "Because the interviewer changed tasks, we did not see whether Gabriella could continue the pattern on her own," as well as suggestions for obtaining more evidence, e.g., "I would have asked the child to make her own pattern to see whether she understood the repeating concept."

The reviewers' analyses indicated improvements in three of the main variables of concern: claims, relational statements, and modest statements. The number of claims decreased significantly across the three essays, perhaps because students learned to make fewer claims in order to better defend them in the space allotted. The amount of cited evidence remained relatively constant throughout the essays, but when considered in light of the decreasing number of claims, the amount of evidence per claim increased, suggesting that students made more of an effort to substantiate their claims. The number of relational statements increased significantly, suggesting perhaps that students learned to take greater care in explaining why their selected evidence supported their claims. Most interestingly, perhaps, was that the number of modest statements—as reflected by the students' use of conditional language as well as statements acknowledging missing evidence—increased dramatically across the three essays.

The larger question remains whether these results imply that students developed an ability to engage in more sophisticated arguments. According to the definition of informal argument offered earlier, the students did appear to learn to better coordinate their claims and evidence: they tipped the ratio of these two elements in the right direction, and they learned not to allow claims and evidence to stand alone, without explaining what the evidence showed substantively (i.e., not merely recounting the events

captured in the video), and how it related back to the claim. The students also showed progress in their development of intellectual humility; by essay 3, many students appear to have acquired a respect for evidence and the reasonable limitations of their claims.

Conclusions and future directions

What factors are responsible for producing these results? Observation, interpretation, and argument skills were expected to improve in the course context generally. The evidence from the essay analyses suggests that students indeed improved their skills within the VITAL environment and the course experience as a whole. Students' use of VITAL may be very important in producing this effect, but other elements of the course could contribute as well; the assignments within VITAL were embedded in an environment in which argument skills were modeled in lecture and encouraged in discussion, sometimes implicitly and sometimes explicitly. Thus, further research is needed to investigate the nature of the improvement in richer detail and to determine the extent to which various factors, such as VITAL itself or other aspects of the course experience, influenced the improvement.

An even greater leap of faith lies between the results of this experiment and actual classroom practice. Because we have not followed our preservice teachers into the field after graduation, we do not yet know how whether their experiences in VITAL— including their development of observation, interpretation, and argument skills—have an impact on their teaching. We trust that our efforts to help them develop an "enlightened eye" for children's thinking and behavior, and our encouraging them to think about how

they can use evidence to inform teaching and assessment, will help them in the complex

world of the classroom.

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