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Evaluating Video Models of Evidence-Based Instructional Practices to Enhance Teacher Learning

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A process was developed to create Web-based video models of effective instructional practices for use in teacher education settings. Three video models, created at three university sites, demonstrated exemplary implementation of specific, evidence-based strategies in reading, math, and science. Video models of strategies were field tested with preservice and practicing teachers working with diverse student populations. The authors provide an explanation of the video development process and present field-test data that demonstrate the influence of video modeling on teacher learning.

Keywords: *web-based video; evidence-based practice; reading; math; science*

One of the most enduring problems in education is the gap between research and practice (Carnine, 1999; Denton, Vaughn, & Fletcher, 2003; Martinez & Hallahan, 2000). This problem poses a challenge for teacher educators to find methods to help practicing and preservice teachers effectively learn and implement evidence-based practices. In an attempt to address the research to practice gap, we developed and evaluated a process for creating and applying video models of effective practices for teacher education.

The use of video shows promise as a method for making practices more accessible for teachers (Dhonau & McAlpine, 2002; Kpanja, 2001). The use of technology is increasing in all aspects of society, making dissemination of information easier than ever and providing a tool to bridge the research to practice gap. The purpose of the Learning Stream project was to develop an effective process for creating video models of exemplary instructional practices in reading, math, and science. More specifically, the project focused on creating video appropriate for online delivery and ensuring that the videos aided teachers in understanding and retaining information about evidence-based practices. The secondary purpose of the project was to evaluate the effectiveness of video models created using this process.

Potential for Video Models in Teacher Education

The national shortage of teachers in fields such as special education continues to be chronic and severe (McLeskey, Tyler, & Flippin, 2004). As the shortage of teachers in many fields continues at a critical level, states are using more alternative certification routes (Rosenberg & Sindelar, 2001). In some states, at least temporary teacher certification can be obtained by anyone holding a bachelor's degree who can pass the certification examination (e.g., Florida; see Florida Department of Education, 2006). Despite No Child Left Behind's requirement for highly qualified teachers, many educators are not certified in the areas they are assigned, which contributes to the attrition problem (Brownell, Smith, McNellis, & Miller, 1997). These issues pose an even greater problem for teachers who work with students with special needs and related learning problems (Office of Policy Research and Improvement, 2002). Therefore, high-quality teacher preparation and professional development methods for teachers are essential.

Teachers who are entering the field are faced with increasing demands and accountability for student progress. Novice teachers typically have had limited exposure to expert teaching, and out-of-field teachers may have had no exposure at all. Out-of-field teachers do not have the same luxury as those prepared in a teacher education program to watch and learn from a master-level teacher. Because teachers learn to teach by relying on a combination of their experience as students and skills gained through teacher education (Goodlad, 1994), out-of-field teachers must rely on how they were taught in school, which may or may not represent effective practices. McMaster and Fuchs (2005) noted that many teachers struggle to translate effective learning theories into practice.

Although the use of visual models of effective practices can be a beneficial tool for developing teachers (R. J. Beck, King, & Marshall, 2002), college courses typically provide only limited access to video examples. Research on the use of video instruction in teacher education is limited, but findings thus far have supported its use in the preparation of teachers to implement effective practices. For example, Friel and Carboni (2000) used a video pedagogy approach in a mathematics teacher education program. Findings suggested that the use of video pedagogy enabled preservice teachers to move beyond didactic instruction to more student-centered reflective practice. The video enabled the preservice teachers to broaden their understanding of the development of mathematical thinking and of how to provide instruction with these concepts in mind. Schrader, Leu, and Kinzer (2003) conducted research on the preparation of pre-service teachers to provide literacy instruction. Their study was conducted using traditional instruction, commercially produced instructional video, and case-oriented video, and their results indicated that pre-service teachers developed greater confidence in their ability to implement research-based practices in literacy instruction after viewing video as a supplement to traditional instruction. Qualitative differences favored the more interactive use of case-based video examples. O'Brien, Dieker, and Platt (2006) used video models to teach learning strategies directly to students. Data analysis, both qualitative and quantitative, suggested that video models improve the practicality of implementing effective instruction.

Drawing from the work of the Cognition and Technology Group at Vanderbilt (1990), several researchers (e.g., Glaser, Rieth, Kinzer, Colburn, & Peter, 1999; Rieth et al., 2003) in the areas of instructional technology, teacher education, and special education have examined the potential of video-based anchored instruction. Their research suggested that video serves as a strong learning tool, which enables instructors to build on or bypass basic text-based instruction. The use of anchored instruction has recently begun to extend to the preparation of preservice teachers via multimedia case-based learning, interactive video being an essential part of these cases (Kinzer & Risko, 1998). Video models of effective teaching provide a variation of anchored instruction, defined as learning within a meaningful, problem-solving context (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990).

As indicated in several meta-analyses, there are numerous pedagogical benefits to using video models (Bosco, 1986; Fletcher, 1989, 1990; McNeil & Nelson, 1991). Digital technology can enable teacher educators to use instructional methods that are more effective than traditional lectures, potentially providing effective ways to engage students in active learning and offering easy access to vast amounts of information (Teh, 1999). *Interactive video*, the term typically used in the literature, allows learners to interact with the media (i.e., stopping to read overlaid text, replaying segments). Rather than passively viewing an instructional video on television or in class with an instructor playing clips, interactivity refers to the learners' ability to control the video and monitor their own learning (Wetzel, Radtke, & Stern, 1994). When people are actively involved in a self-driven learning project, they learn more and remember it longer than when they are passively sitting and listening (Newman & Scurry, 2001).

Video-streaming technology makes video readily accessible and allows the users to control the rate and repetition of their viewing (Fill & Ottewill, 2006). Streamed video is produced in a digital format that allows easy access via the Web. Deal (2003) explained that accessing streaming video is analogous to "drinking from a water fountain as compared to filling a glass of water and then drinking—you don't have to fill the glass first" (p. 19). Unlike traditional VHS or DVD video formats, streamed video can be shared free of charge and can be made available on an ongoing basis, thereby providing teachers flexibility in when and where they engage in professional learning. Other interactive features, such as audio narration and text elaboration, can be integrated into streamed video to enhance the learning experience (MacDonald, Stodel, Farres, Breithaupt, & Gabriel, 2001). The digital format also allows for customized viewing options for novice or veteran teachers and for teachers who are interested in a particular element of instruction. Despite the potential impact of Web-based video models on teacher and student learning, research in this area is sparse and the effects unclear (Hughes, Packard, & Pearson, 2000). A Web-based video library of effective teaching practices, however, could provide beginning teachers with an array of actual classroom examples that (a) consistently represent exemplary practice, (b) are constantly accessible during their preparation, and (c) continue to be available throughout their career.

The Learning Stream Project

The Learning Stream project was a collaborative endeavor across three Florida university sites: University of Florida (UF), University of Central Florida (UCF), and University of South Florida (USF). The primary purpose of this project was to develop an effective process for creating videos of exemplary instructional practices in reading, math, and science. The responsibility for each content area was divided among the three universities (i.e., reading at UF, math at USF, and science at UCF). A secondary purpose was to collect preliminary data on the use of these models on teacher understanding and retention of information on effective practices. To address the intent of the study, each university site focused on (a) developing a video model in one content area and (b) evaluating teacher learning gains related to that video. Video footage was collected at a university research school, and the participating teachers were selected for their expertise in the content area as well as for their reputations as exemplary teachers. The project was conducted across two phases. In the first phase, the university teams worked collaboratively to develop and implement the video production process. In the second phase, each site team worked independently to test the effect of its finished product on teacher learning. During the second phase, all sites placed pre-service and/or in-service teachers into two randomly assigned groups and provided these teachers with either a video model or a verbatim transcript of the lesson presented in the video model. These preliminary data were evaluated at each site to determine if and how viewing video models influenced learning outcomes.

Video Development Process

To evaluate the effects of Web-based videos, we first developed a process to create video models of exemplary teaching. We identified evidence-based practices, identified the essential characteristics of these practices, developed video vignette scripts, collected video footage, and edited it to ensure demonstration of the teaching practice. At various steps in the process, we obtained feedback from experts in the field and from teachers and university students regarding the quality of the content and social validity of streamed video models. The experts were researchers who had studied the chosen strategy and could validate that the products accurately reflected the critical components of each specific strategy. These experts were critical in ensuring that the observation tools created were valid and that they reflected the key components of the strategy being measured. The following is a brief summary of the "step-by-step" process used by the Learning Stream.

Selection of Evidence-Based Practices

Review of research. This stage involved an extensive review of the literature related to effective practices in each of the content areas. This process allowed us to select evidence-based practices and to identify the essential characteristics of these practices that needed to be portrayed in the video models.

Practice outline. Once the project team members identified the research-based instructional practice to be captured on video, the key elements of the instructional strategy and essential characteristics of effective implementation were outlined. To accomplish this, in addition to reviewing research literature, we consulted with researchers who had either developed the strategy or evaluated its effectiveness to ensure that we understood what was necessary for effective strategy implementation.

Vignette Script Development

First draft. Different approaches were employed to develop scripts, from writing all dialogue expected from teacher and students to providing an outline of essential lesson components and letting the teacher generate the dialogue naturally. The outcomes were similar in that, in each case, a lesson was produced that reflected the components of "best practice."

Script revisions. An expert reviewer was essential in determining whether the plan for the lesson reflected the key components of evidence-based practice, if the script was appropriate for the proposed student audience, and whether the lesson was flexible for meeting the needs of all learners. A teacher also reviewed each script to ensure that the dialogue and practices were plausible in a classroom setting.

Storyboard development. Once a project team developed the final script, storyboards were created to map out the scenes of the lesson. These storyboards were typically sketches of the scene consisting of essential information such as location of the cameras and positioning of teachers and students in the shot. The video shoot was based on these storyboards. One team creatively used PowerPoint and clip art to stage each shot to be captured of the evidence-based practice.

Internal review. Team members met across sites via videoconference on a regular basis to provide internal review and critique during each stage of the project. These meetings also served to maintain communication about challenges and procedural issues.

Video Production

Video shoot preparations. Prior to shooting the video, many issues related to equipment needs, technology, teachers, students, and instructional materials were carefully considered and addressed. Preparation for a video shoot requires more than having the correct equipment and technology. The day of the shoot must be explicitly planned for, with all details organized and any problems anticipated.

Video shoot fidelity. During the shoot, taping followed the predetermined script and storyboards with as much fidelity as the energy of the moment allowed. The teachers and students were not actors, so the shoots had to allow for natural interactions that may have varied from the planned script. The researchers were present during the video shoot to ensure that each essential strategy component was satisfactorily captured.

During-shoot logging procedures. An important aspect in the shoot process was logging of critical times and events on a logging sheet to aid in later editing. This logging process aided the editing team when they captured the raw video into the computer editing station. The researchers logged specific events that were essential and others that should be cut.

Editing process. Once the video footage had been shot and logged, the video was captured and the editing process began. At this point, the video production team worked to create a highly engaging final product. Each video went through several stages of editing and review.

Review of video products. The project team members who selected the research-based practice were at a disadvantage for developing the final edited product because they were too close to the instructional strategy. At this point in the process, it was essential to ensure that the strategies were portrayed in an accurate and understandable way. As the final product was developed, we engaged our experts again for a second external review. They were instrumental in helping the team determine whether video accurately reflected the research-based instructional practice. We also asked novices to view the video and to explain what they learned from it. This novice review helped us ensure that practices were portrayed in an understandable way.

Streaming. The final step in video development was the streaming of the video models. The streaming process typically involves two separate processes. The first process involves compressing the video that has been gathered into a format that can be stored on the hard drive (e.g., AVI, MOV, or MPEG). In the first part of the process, the file size is reduced by varying degrees, depending on the rate of the speed at which the data are being transmitted to the end user. The second part of the streaming process was buffering the file. Buffering is a process in which a reserve of video is being loaded during the first few seconds so that the file is started almost immediately and can be played without interruption. For our project, we selected RealOne formatting and a type of coding that allowed for greater flexibility and product development. The videos were developed using Synchronous Multimedia Integration Language (SMIL), which allows the video products to be modified to fit specific user needs. The strength of using SMIL is that the video does not have to be recreated for different users, but instead, the entire video can be placed on the streaming server and the delivery modified according to the user (e.g., extensive voice and text elaboration for a novice teacher and a brief clip with little explanation for a veteran). Using SMIL, the research team can continue to develop and add various support material (e.g., slides with voice overlay) to assist the learner in understanding the video models. This type of interface allows maximum flexibility of video produced for use across multiple sites and institutions.

Evaluation

The first phase of the project focused on the creation of a video development process that would result in video that accurately portrays evidence-based instructional strategies and content-specific learning strategies for a diverse learning population. The second phase of the project focused on evaluation of learning through field testing of the videos. Specifically, the university teams were interested in measuring the influence of Web-based video models of effective practices on teacher learning about evidence-based strategies. The primary research questions addressed in this phase were the following: (a) What were the effects of Web-based video models on teachers' knowledge of evidence-based teaching practices? and (b) What were the effects of Web-based video models on teachers' implementation of evidence-based teaching practices? The field testing was preliminary in nature. The data collected were not intended to demonstrate statistically significant differences but to determine if and how the model of videos influenced teachers' learning and retention of the practices portrayed and which elements required further study.

Data collection for this project included a variety of methods and procedures that were uniquely tailored to each content area and to each university's teacher education program. The three participating universities serve predominantly White, middle-class, female students in their teacher preparation programs; therefore, the evaluation phase was carried out with this population. The pre-service component was conducted within required courses, one at the graduate level and two at the undergraduate level. Central to the use of video models in teacher education is the capacity to adapt the implementation to teacher educators' goals, methods, audiences, and styles. The purpose for using video models may be to introduce a strategy to a class of undergraduates new to the field, to improve the performance of student teachers nearing the end of their teacher preparation, or to enhance the practices of experienced teachers. Therefore, the researchers at the university sites selected participants, video implementation procedures, and data collection methods that would naturally occur in their pre-service and in-service teacher education efforts and that addressed one or more of the research questions. Each of the three university teams conducted field testing of the video model related to its content area focus. The results of these field tests are reported accordingly.

UF Team: Reading Instruction

The work at UF focused on a reading strategy called Text Talk. Text Talk is a read-aloud strategy developed by I. Beck and her colleagues (I. Beck & McKeown, 2001; I. Beck, McKeown, & Kucan, 2002) to enhance comprehension. A key focus of Text Talk is vocabulary development. In a Text Talk lesson, the teacher introduces new words explicitly by providing student-friendly definitions. For each word, the teacher engages students in activities that make them interact with the word's meaning. The strategy is complex and difficult to effectively carry out. For this project, the focus was on the elements of Text Talk related to explicit vocabulary instruction. The team evaluated the effects of the video model on prospective teachers' knowledge of the strategy and on practicing teachers' implementation of the strategy.

Pre-Service Teachers

Participants in the first study were a group of students in a methods course on language and literacy instruction for students with disabilities. The group included 23 pre-service teachers, including 22 women and 1 man; 19 were White, 2 were Black, and 2 were Hispanic. To evaluate the prospective teachers' preexisting knowledge of the strategy, participants were asked to write a description of the Text Talk strategy before receiving instruction on the strategy. All participants then received traditional lecture-style instruction about the strategy and were subsequently randomly assigned to one of two groups. The video group ($n = 12$) viewed the video model of a Text Talk lesson, whereas the no-video group ($n = 11$) read a detailed description of the same lesson that included a verbatim transcript of the videotaped lesson dialogue with descriptions of teacher and student actions. The groups had continued access to either the video (via the Web) or the written lesson description for 1 week.

After 1 week, all participants wrote another description of the strategy. Pre- and postinstruction strategy descriptions were scored based on inclusion and accurate description of six key lesson elements:

1. Teacher reads story aloud and leads discussion using open-ended questions
2. Teacher introduces three to five appropriate target words
3. Students say the word to reinforce phonological representation
4. Teacher introduces a student-friendly definition of the word
5. Teacher engages students in activities that prompt them to think about the word's meaning
6. Teacher engages students in activities that require them to use and interact with the word

As evidenced by the preassessment, only three participants had any prior knowledge of the strategy, and even this knowledge was extremely rudimentary. One of these participants wrote, "Text Talk is a strategy for discussing text and gaining vocabulary info from the discussion." Another simply explained, "Kids build vocabulary through book discussions." The third said, "Text Talk is using text to pick out vocabulary as a stepping-stone for discussion." Given the name of the strategy and the fact that instruction was in the context of a section of the course addressing vocabulary, such descriptions may actually reflect a prediction rather than prior knowledge of the strategy. All the remaining participants indicated that they did not know anything about the strategy.

Postassessment yielded evidence of far better understanding from both groups. All participants were able to describe some strategy elements, but those in the video group demonstrated that they remembered more details about strategy implementation and had a better understanding of the essential elements of the strategy.

The percentage of students in the video group incorporating the six effective strategy elements represents a clear contrast to students in the no-video group. Only 45% of students in the no-video group included Element 1 (reading and discussing the story), compared to 100% of students in the video group. Similarly, only 27% of students in the no-video group included Element 6 (teacher engages students in activities that require them to use and interact with the word), compared to 83% of students in the video group. Furthermore, 75% of students in the video group included Elements 2 (teacher introduces three to five appropriate target words) and 4 (teacher introduces a student-friendly definition of the word) in their strategy description, compared to 45% and 27% of the students in the no-video group, respectively. Consistently low was the inclusion of Elements 3 (students say the word to reinforce phonological representation) and 5 (teacher engages students in activities that prompt them to think about the word's meaning) in the strategy description. Of students in the video group, 50% included these elements, as opposed to 9% and 36% of students in the no-video group.

The participants were asked to report whether and how much they had reviewed the materials (video or lesson description) independently during the week. Of the 12 participants in the video group, 11 reviewed the video at least once, and 4 of those reviewed it more than once (two or three times). Only 3 of the 11 participants in the no-video group reported reviewing the lesson description, and those 3 each reread it only once. All participants were encouraged to review the strategy in the intervening week, but it was not a requirement. The greater gains of the video group in the development of their knowledge about the strategy may have been attributable to the additional exposure to the strategy as opposed to any superiority of the video method. It is interesting to note, however, that nearly all the participants in the video group were motivated to review the strategy and very few in the no-video group were so motivated. Students in the video group reported that the video was engaging and helped them understand the strategy more deeply. Following the posttest, participants in the no-video group were given access to the video and participants in the video group were given access to the written lesson description. All of the participants in the no-video group reported finding the video helpful, even after reading the description. In contrast, none of the video group participants found the written description helpful after viewing the video.

Practicing Teachers

The UF team also wanted to evaluate the effects of the video model on the implementation of the model by practicing teachers. As part of an ongoing professional development effort at a high-poverty elementary school, practicing teachers were engaged in a 3-month study of vocabulary instruction. Teachers were provided with an overview of recent research related to vocabulary development and instruction, and they read and discussed

Bringing Words to Life (I. Beck et al., 2002), a book that includes a detailed explanation of each element of Text Talk. They then received further, more explicit training on the elements of the strategy. This training consisted of a lecture with a PowerPoint presentation and modeling, guided practice developing student-friendly definitions, and guided practice developing Text Talk lesson plans. After this, the teachers developed detailed lesson plans independently. Lesson plans of 11 K-3 teachers were evaluated using the same criteria as in the examination of pre-service teachers' descriptions. Two researchers reviewed the teachers' lesson descriptions and scored the lessons according to the rubric. Interrater agreement was 100%. The teachers consistently included all the elements of the strategy, but there was a wide range of quality, especially in the development of student-friendly definitions.

Observation of teacher implementation of the strategy in their classrooms was necessary to more fully understand how teachers were using the strategy. Using an observation tool that focused on implementation of Text Talk, two kindergarten teachers were observed before and after viewing the streamed video. Two researchers conducted the observations simultaneously, and interrater agreement was 100%. Before viewing the video, both teachers included each element of the strategy in their lessons, but the level of student engagement—a critical element of Text Talk—was low. The activities the teachers chose were not particularly engaging (e.g., "Raise your hand if you think this is *extraordinary*"), and neither teacher spent much time checking for students' understanding of the target words. Following the first observation, teachers watched the Text Talk video model. They then developed another lesson and were observed a second time. During the second observations, both teachers not only included each element of the strategy but also implemented more engaging activities, provided clearer student-friendly definitions, and checked each student's understanding of the target words. They both reported that, from watching the video, they learned about nuances of the strategy that were not clear from either reading the book or participating in the training. They also reported that they were far more confident in their lesson implementation after viewing the video model. One teacher stated, "Seeing another teacher do what I had tried to do made it clear to me how I needed to improve." The second teacher reported, "It wasn't until I watched the video that I really understood the strategy. I thought I understood it before, but I really didn't. A picture's worth a thousand words (or maybe more)!"

USF Team: Mathematics Instruction

The work at USF focused on the Dynamic Assessment in Mathematics strategy. Dynamic Assessment in Mathematics integrates four research-supported assessment practices in mathematics for use by classroom teachers to determine what to teach and how to differentiate instruction based on the level or levels of understanding their students possess: (a) student interest inventory, (b) concrete to representational to abstract assessment, (c) error pattern analysis, and (d) flexible math interview (Bryant, 1996; Ginsburg, 1987; Howell, Fox, & Morehead, 1993; Kennedy & Tipps, 1998; Liedtke, 1988; Mercer & Mercer, 2004; Van de Walle, 1994; Zigmond, Vallecorsa, & Silverman, 1981).

Pre-Service Teachers

Participants were 22 pre-service teachers in a single, intact mathematics methods course. All participants were female and White. Instruction included a brief introduction followed by a PowerPoint presentation with class discussion, including handouts that further illustrated important aspects of the strategy. Participants were then randomly assigned to either the video or the no-video group.

After class instruction, the no-video group (n = 10) moved to a nearby classroom. In addition to the handouts that all students in the class received, participants in the no-video group were provided a lesson plan that illustrated the Dynamic Assessment strategy. The lesson plan was the same one used by the teacher in the video. First, all students in the no-video group individually reviewed the lesson plan and other handouts. Then, they broke into smaller groups and responded to questions structured to facilitate discussion about important aspects of the strategy. The video group (n = 12) sat together in small cooperative groups to view the video and discuss what they learned by responding to the same questions about the strategy as the no-video group. Students in both the video and the no-video groups had access to the same information about the strategy, but the video group also had access to the video.

Students responded to a questionnaire about the strategy before and after instruction. The questionnaire included four items that required participants to identify important features of the strategy (e.g., the name of particular assessment techniques, their purposes, etc.). It also included a narrative prompt that required participants to describe how they would implement the strategy in a classroom context. A scoring rubric was used to evaluate responses for both types of items. The scoring rubric for the first four questions included a 5-point rating scale for each item, with a total possible score of 20. The narrative scoring rubric evaluated each student's response on the extent to which it incorporated seven important features of the strategy:

1. Included all four assessment strategies
2. Dynamic Assessment steps included and appropriate
3. Dynamic Assessment steps put in correct sequence
4. Importance of conceptual and procedural understanding included
5. Importance of receptive and expressive abilities included
6. Teacher use of data to make instructional decisions included
7. Application to classroom context included

Each feature was evaluated using a 5-point rating scale as well. The total possible score was 35. Scoring procedures included two scorers. Two researchers met to discuss the scoring rubrics and to reach consensus regarding what type responses warranted each score on the 5-point scale. The researchers then completed scoring the response sheets and compared scores to determine agreement. In several instances the two scorers discussed their different scoring interpretations and reached consensus regarding the scores. Scorers did not know the identity of the responders or whether they were in the video or no-video group.

On the first measure, mean scores for members of the video group were 3.4 pre- and 3.7 posttest for the "describes purpose(s) of Dynamic Assessment" item, compared to 3.0 pre- and 3.4 posttest for no-video members. For the "names four assessment strategies integrated within DA" item, mean scores for the video group were 3.2 pre- and 4.8 posttest, compared to 3.3 pre- and 4.9 posttest for the no-video students. For the "describes purpose for each of four integrated assessment strategies" item, mean scores for the video group were 2.5 pre- and 4.7 posttest, compared to 2.9 pre- and 4.8 posttest for the no-video group. Finally, for the "describes important elements/ideas related to each of the four integrated assessment strategies" item, video group mean scores were 1.6 pre- and 4.4 posttest, as compared to no-video group mean scores of 2.5 pre- and 4.8 posttest. Scores from the seven element rubrics are reported as mean ratings for total scores for the written narrative response. Students in the video group scored 7.8 pre- and 9.4 posttest, compared to the no-video group with scores of 7.4 pre- and 8.9 posttest.

All of the pre-service teachers enrolled in this mathematics methods class demonstrated greater knowledge of the strategy from pretest to posttest. It should be noted that there were differences between groups at pretest, with the no-video group scoring higher on three of the four recall prompts and the video group scoring higher on the narrative prompt. On the recall questions, differences between the groups ranged from 0.13 to 0.92 on a 5-point scale. Therefore, mean gain scores were used to evaluate group performance. On the responses to the narrative prompt, the difference between the mean composite score was 0.35 (a total of 35 possible points could be obtained with ratings of 5 on each of the seven DA elements). No apparent outward differences between groups can be attributed to the differences in pretest scores. The video group demonstrated greater overall gains from pretest to posttest compared to the no-video group. On the four recall prompts, the video group gained 8.3 rating points and the no-video group gained 6.3 points. On the narrative prompt, the video group gained 1.66 points and the no-video group gained 1.5 points. Gains for recall were generally more pronounced for both groups, whereas gains in the ability of participants to apply knowledge in context were less impressive. Participants in both groups demonstrated little ability to describe in detail how they would apply the strategy in a classroom context.

Two factors that may have influenced the performance of both groups were the complex nature of the Dynamic Assessment strategy (it integrates four different research-supported assessment strategies) and the short time frame allowed for learning the strategy (approximately 1 hour). These factors may have had the greatest impact on the written narrative because this task requires deeper levels of understanding and synthesis. It was noted by faculty administering the posttest that students appeared more tired at the end of the lesson compared to the beginning, so fatigue could have also played a role in the performance of both groups. Finally, although students were randomly assigned to groups, some differences existed between groups at pretest. No pattern was observed regarding these differences. Informal discussions with the pre-service teachers who viewed the video revealed that they appreciated the opportunity to observe a real teacher implementing the strategy rather than simply hearing how it should be implemented from their instructor. One student commented, "I liked both seeing the teacher do it and hearing what she had to say about it."

UCF Team: Science Instruction

The focus of the work at UCF was science instruction. The strategy depicted in the video model was the 5E Learning Cycle, a method for directed inquiry in science that includes five steps: Engage, Explore, Explain, Extend, and Evaluate. Although it is important that the steps of the 5E strategy are correctly implemented, the most critical element of strategy implementation is a focus on inquiry through effective questioning and guidance of student exploration. Two field tests were conducted—one with 11 pre-service teachers and another with 6 practicing teachers.

Pre-Service Teachers

All 11 pre-service teachers were female, 2 were Black, and 9 were White, including one student with a hearing impairment. A science education professor provided a 1-hour lecture on the 5E Learning Cycle to a class of pre-service special education teachers. Following the lecture, 11 students completed a pre-intervention assessment of their knowledge of the 5E Learning Cycle based on the traditional lecture and were then randomly assigned to either the video or the no-video group. The video group received the URL for the streamed video that they were to view prior to the next class meeting. The no-video group received a detailed written description of the same lesson that was implemented in the video model. Following exposure to either the video or the written description, all students completed a postintervention assessment.

Although the video group demonstrated slightly better gains in knowledge of the names of the steps of the 5E Learning Cycle (10% gain vs. a 3% gain in the no-video group), no significant differences were noted between groups in their ability to explain the steps. Unfortunately, the area surrounding UCF experienced severe weather conditions, and there was an unplanned 2-week delay in the collection of posttest data. We believe the delay and the inherent distraction and disruption likely influenced the outcome data. Participants who watched the video model reported consistently positive impressions of their experience.

Practicing Teachers

The second field test examined the effects of video on practicing teachers' understanding of the strategy. The six practicing teachers were four women and two men; all were White. The teachers were randomly assigned to either the video or the no-video group. All participants completed pre- and postassessments of their knowledge of the 5E Learning Cycle. The researchers conducted observations of the teachers' implementation of the strategy. A rubric was used to evaluate each lesson's adherence to the 5E model and the quality of implementation. Neither group received any type of explicit instruction in the instructional strategy prior to random assignment or after they received the written plan and the video. The video group was given a Web link to access the streaming video available from the university server. This video presented a lesson in a science classroom implemented with the 5E Learning Cycle instructional strategy. Included in the video was a series of text slides with narration intended to further clarify the strategy and elaborate on the activities in the video. The no-video group was given a written description of the lesson depicted in the video model, but they did not watch the video. The written description fully explained all elements of the 5E Learning Cycle lesson, including an explanation of each step and activities to correspond to those activities.

All participants completed a pretest to assess their (a) knowledge of the steps of the 5E Learning Cycle (i.e., Engage, Explore, Explain, Extend, Evaluate) and (b) description of the activities and rationale related to each of these steps. Two separate scores were obtained. The participants' understanding of rationale and activities was evaluated using a rubric indicating target descriptions.

Knowledge of strategy steps. Regarding knowledge of the steps, one participant in the no-video group demonstrated a very strong grasp of the steps of the Learning Cycle (100% knowledge) prior to assignment to one of the instructional groups. One other participant in the video group had some prior knowledge of the steps (20% knowledge); however, the remaining four participants in both groups were completely unaware of the steps (0% knowledge of the steps).

Following their random assignment to video and no-video groups, participants completed a posttest of their knowledge of the 5E Learning Cycle steps. Participants in the video group showed improvement regarding knowledge of the steps (100%, 80%, 100%), for a mean score of 93%, as opposed to participants in the no-video group (100%, 20%, 100%), for a mean of 73% accuracy. Furthermore, the video group demonstrated a greater mean improvement in knowledge of the strategy steps (difference of 86%) as compared to the no-video group (difference of 40%).

Knowledge of activities and rationale. Rubric scores for knowledge of the rationale and activities for each of the 5E steps are reported as percentage scores based on a total rubric score of 30 points, reflecting a range of response from no knowledge to in-depth understanding. Prior to random assignment, two participants exhibited a fair to strong knowledge of the rationale and activities implemented in an inquiry-based strategy such as the 5E Learning Cycle (77%, 50%), one participant had moderate knowledge (43%), and the remaining participants had virtually no knowledge of the strategy (0%). Following random assignment, participants in the video group scored 80%, 87%, and 77% accuracy on description of the activities and rationale, as opposed to participants in the no-video group, who scored 77%, 27%, and 43%.

Interesting to note was the marked improvement in knowledge of the rationale and activities incorporated in the 5E Learning Cycle among members of the video group (pre–post difference of 63%) as compared to the no-video group (difference of 10%). Two participants in the video group, who had no prior understanding of this instructional strategy, had the highest rubric scores of the total group on the posttest (scores of 80% and 87%). All members of the video group improved in their knowledge of the steps, rationale behind the steps, and activities to implement, whereas members of the no-video group made very little or no improvement in their knowledge of rationale and activities. In fact, the participant who had previously demonstrated a high rubric score (77% accurate) for rationale and activities did not improve at all on the posttest (again 77%), despite a fair amount of room for improvement.

Strategy implementation. Participants were assessed on their ability to implement the 5E Learning Cycle using an observation guide, which included what were determined to be the critical elements of this inquiry-based strategy. Critical elements included the steps Engage, Explore, Explain, Extend, and Evaluate, appropriate establishment of the learning environment, and provision of necessary accommodations for diverse learners. On several of the five steps, there were subelements that were critical to exemplary implementation of this strategy:

1. Created interest and generated curiosity in the topic of study (Engage)
2. Raised questions and elicited responses from students to assess prior knowledge (Engage)
3. Gave students opportunities to work together without direction from the teacher (Explore)
4. Prompted students to explain concepts in their own words, ask for evidence and clarification, and listen critically to one another's and the teacher's explanation (Explain)
5. Prompted students to apply concepts and skills in new situations using formal labels and definitions (Extend)
6. Asked open-ended questions and looked for answers that use observation, evidence, and previously accepted explanations (Evaluate)
7. Asked questions that would encourage future investigations (Evaluate)

Participants were scored as effective or ineffective on 10 total elements. Two researchers reviewed the preservice teachers' performances and scored the lessons according to the rubric. Interrater agreement was 100%.

Again, the video group appeared to outperform the no-video group in their implementation of this strategy. The percentage of critical elements effectively implemented for members of the no-video group was 40%, 50%, and 30% based on the possible 10 effective elements, whereas the video group members scored 80%, 100%, and 80%. This indicates that the members of the video group were more effective in using the strategy in their classroom. Although members of the no-video group implemented activities and steps of the strategy, their lessons all lacked a true inquiry focus. Participants who viewed the video consistently demonstrated a stronger use of open-ended questioning, student-directed exploration, and clarification, demonstrating genuine inquiry. It seemed that members of the video group developed a stronger sense of the "essence" of the strategy, whereas teachers in the no-video group demonstrated only surface-level knowledge of the strategy.

Discussion

We sought to develop a replicable process for creating Web-based video that accurately represented exemplary implementation of evidence-based practices. Such a process has the potential for making video development more cost-effective for individual faculty members without having to outsource video development to private vendors. We believe that a systematic video development method will also lead to video models that accurately capture the essential instructional features of evidence-based practices.

With these established procedures in place, we wanted to know what the effects of Web-based video models are on teacher knowledge of evidence-based practices, on implementation of these practices, and on student learning. Although our field testing of the video models is clearly preliminary, it has produced some promising results. Video models enhanced learning of both prospective and practicing teachers across the three university sites. Both novice and veteran teachers expressed a preference for viewing video models of exemplary implementation of strategies over simply reading about or hearing about the strategies.

We also learned some unexpected lessons as we conducted this series of field tests. For example, novice teachers may not learn best from simply watching expert examples. Although the novice teachers shared that they enjoyed watching the videos, many expressed uncertainty about what it was they were supposed to gather from the different video clips. Our anecdotal evidence indicates that, with a simple introduction (either in person or via voice or text elaboration), novice teachers can learn from streamed videos of expert teaching examples. Our novice teachers also indicated that a model can be too good, making effective implementation of a strategy appear to novices to be an unattainable goal. We used outstanding teachers in our models, and some novices responded to their strategy implementation with an attitude of "I could never do that." New technologies allow personalization of the viewing experience. Using SMIL technology, several versions of a video model can be produced from a single videotaped lesson. A novice can watch the lesson with substantial support from text and voice elaboration, whereas a more expert teacher can view the lesson uninterrupted by explanation. Much more work is required to determine which supports are appropriate for which learners.

We also learned that the evaluation of teachers' understandings of and abilities to implement newly introduced instructional practices is difficult. We used a variety of evaluation methods, including recall instruments, narrative writing prompts, and observations, in an attempt to evaluate learning outcomes at multiple levels. The evaluation of teachers' ability to recall important features of an instructional practice was a simple and straightforward process, and the results were easy to analyze. Our attempts to evaluate deeper levels of understanding by teachers and their ability to synthesize or apply that knowledge, however, proved difficult. For example, the narrative writing prompt used at the math field-test site did not provide much useful information. Responses to the prompt were brief in many cases. Perhaps we expected too much in such a short time frame. Perhaps teachers demonstrate deeper levels of understanding if given more time to reflect on what they experienced with the video. Evaluation methods for capturing teachers' understandings of evidence-based practices need to be refined to better capture higher order learning outcomes of teachers.

The results of our field tests, although preliminary, are promising in terms of the potential impact of Web-based video on teachers and student outcomes; however, further research into this area is needed. The three separate field tests reported in this article represent our initial inquiry and were not designed to determine effect or to generalize our findings. Each field-test site used slightly different processes for evaluating the respective videos. This was done because each selected content-based instructional practice and because the university context was different in content, complexity, and class structure. Nonetheless, we learned some important information about the use of Web-based video in teacher education. It is important that positive effects from the video on teacher outcomes were found across the three separate sites. This finding is encouraging, particularly given the variations in the instructional practices and the contexts of each field-test site. We learned that Web-based video can be used in a variety of teaching contexts and can be tailored to meet the realities and needs of different teachers.

A picture—or in this case a video—is worth at least a thousand words, and we believe that no lecture or textbook can come close to conveying the practice as well as the dynamics of a video model of exemplary classroom instruction. Although the use of video models of evidence-based teaching practices holds substantial promise for enhancing knowledge and practice of prospective and practicing teachers, numerous questions remain. How generalizable would our findings be with larger-scale implementation? Can teachers effectively generalize a strategy to age groups or populations significantly different from what is depicted in the video model? How effectively can the video models we produced be used by other teacher educators? What is the role of multiple viewings of a Web-based video model? How replicable is our video model creation process? Further research in this area is clearly needed.

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