Using Virtual Classroom: Learning through Video Analysis to Engage Educators in Meaningful Facilitated, Online Distance Learning

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ABSTRACT
NanoTeach is a National Science Foundation sponsored Discovery Research K-12 project, (#DRL-0822128), led by Mid-continent Research for Education and Learning (McREL) with assistance from partner organizations: Stanford Nanofabrication Facility, Georgia Institute of Technology, and Aspen Associates. NanoTeach is developing and evaluating a professional development model intended to assist high school educators in integrating nanoscience and technology into their curriculum in life, physical, or earth science to promote student understanding. Using instructional strategies from Designing Effective Science Instruction [4], NanoTeach supports educators in designing and implementing lessons that integrate emerging content in a manner that reflects effective science instruction. In this project, the emerging science content of nanoscience and technology intersects with the pedagogical shift to create a coherent content storyline to increase educator understanding and practice by seeing and listening to active science instruction in a classroom through synchronous video coding. The learning platform, Virtual Classroom: Learning through Video Analysis (VC-LVA), effectively integrates distance learning, collaboration, and discourse among educators, using technology.

Keywords: Virtual, Classroom, Video, Distance Learning, Professional Development, Online, Educator, Storyline, Strategies

1. INTRODUCTION
VC-LVA is an innovative component of the NanoTeach project, which was field tested in 2012-2013 (Figure 1). This component virtually brought together participating educators from sites representing four states across the country (Colorado, Texas, Georgia, Louisiana). Prior to the VC-LVA experience, educators in the facilitated group participated in an intense two-week summer professional development program and implemented at least one nanoscience and technology lesson during the fall semester. VC-LVA for NanoTeach occurs prior to implementation of their spring lesson. The timing allowed for educators to reflect on their fall lessons and think about how their spring lessons might be improved.

The purpose of VC-LVA is for educators to analyze delivery of science lessons through synchronous video coding of an authentic classroom and determine evidence of strategies used that support a coherent content storyline [3]. These strategies align with Designing Effective Science Instruction, Content Strategy 6: Sequencing the Learning Targets into a Progression [4]. Educators look for evidence of one main learning goal, determine if activities are aligned to that learning goal, and look for evidence that there are explicit links between the science ideas and the activities. Once the main learning goal of a coherent content storyline is identified, it is important to share it with students. The strategies that support creating a coherent content storyline for which educators collected evidence are (adapted from Roth, 2011):

- Focus on one main learning goal
- Link the learning goal (the main science idea) to ideas learned in previous lessons
• Set the purpose using a focus question or goal statement (in kid friendly language)
• Refer back to the goal statement or focus question throughout the lesson
• Select activities and content representations that are matched to the learning goal

For educators, reviewing what a learning goal is and what evidence one might see or hear in a classroom paves the way for understanding how to help students, through facilitation and instruction, build conceptual understanding of even the most difficult concepts. In this way, students have the opportunity to build their knowledge and develop an overall conceptual understanding. A secondary purpose to VC-LVA is providing a tool and a model for educators to use for both self-reflection and peer review based on a video recording of their own lesson in order to improve their practice. Prior to conducting the VC-LVA in the virtual environment, facilitators worked with the educators to practice video coding and determining evidence during the summer face-to-face sessions. This prior experience made for an easy transition to analyzing video in a virtual environment.

2. THE INNOVATION
Using an adaptation of a Cisco WebEx® online meeting system, the VC-LVA platform permitted the presentation of synchronous video viewing. Groups of three to six educators connected with a NanoTeach facilitator through an audio conference and the online, synchronous presentation. This 70-minute interactive session included ongoing discourse orally and through an online chat function. Using the platform tools, participants were encouraged to “raise their hand” using an icon indicator and asked questions and shared their ideas. This prevented participants from talking over one another and let all voices be heard. The facilitator reviewed the pedagogical content and strategies, the focus of the session, and guided the interaction by eliciting feedback, views, and examples from participants.

### Does the Video Matter?

While the video coding strategies and VC-LVA can be used with any instructional video, we found that having a video using a teacher versed in creating a content storyline works best. There should be some evidence of strategies in play yet room for improvement. For the NanoTeach field test, we recorded a physics teacher conducting a culminating lesson on static forces adapted from www.mcrel.org/nanoleap.

The overall desired outcome for teachers in this component of the NanoTeach project is for them to use video analysis to put “words-to-images” [1], to learn or review the strategies that support a coherent content storyline, and to understand what this means when put into practice. The goal of the session is to support educators as they apply this understanding to the design, development, and delivery of their own lessons. Modeling good instruction is also a goal of the Virtual Classroom session.

We began each session by displaying and discussing the learning goals of the session. The specific goals for the VC-LVA are that educators:

1) understand that a content storyline is important to connect student learning from student initial ideas to subsequent ideas as they build a larger conceptual understanding; and

2) recognize that video analysis and coding allows us to examine educator/student interactions by identifying evidence of educator practice to create mental models of what good instruction looks like.

Through facilitated interactions, educators reviewed and used an analysis instrument to record evidence from the video they observed. The instrument includes instructions and strategies that support a coherent content storyline. Teachers had the opportunity to record on the instrument itself or in a notes section on the platform. As educators watched the video, they recorded both the evidence they saw and/or heard from the student/teacher interactions on the video and the time-code at which it the evidence occurred. This allowed for meaningful discussion based on the evidence they recorded and their process of forming an image of what good instruction looks like. The
The facilitator has full control of the video which is shown with little to no delay. The video was paused several times to allow for discourse prompted by the facilitator. Each participant shared evidence they recorded and discussion ensued. To end this synchronous session, participants shared via the chat box two things they saw or heard the educator doing well during instruction regarding strategies that support a coherent content storyline or other ideas that resonated with them. They additionally shared one thing they wished they had seen the educator do during the lesson. To wrap up the session, participants shared how they were going to apply what they learned during the VC-LVA session to their own practice during their spring implementation.

3. FINDINGS

VC-LVA sessions for the field test were conducted in January and February, 2013. 10 sessions were held online using the VC platform with between two to six teachers present at each session. The sessions were typically 70 minutes in duration and included the following elements:

- Welcome and introductions
- WebEx basics
- Learning goals and outcomes
- Review of video analysis basics and the instrument
- Review of content storyline and strategies to look for that support a strong storyline
- Three clips of real-time video and participant coding
- Discussion for each clip
- Reflection
- Two stars and a wish focused on the video
- Wrap-up which included how teachers will apply what they’ve learned
- Update on revised resource inventory
- Questions

For the VC-VLA session, participants used a video coding instrument which was developed for teachers to record evidence they observed in the video for each content storyline strategy. The participants watched a video recorded in a general physics class in a public school. The class consisted of approximately 30 students, tenth through twelfth grades. The lesson was adapted from NanoLeap [5] and was focused on forces and interactions. The educator, a veteran of 24 years, implemented this lesson at the end of a unit on forces.

About one week after the Virtual Classroom (VC) sessions, the project’s external evaluator sent the participants an online survey to determine the overall quality and satisfaction of the experience. What follows are excerpts of the participant perceptions of this experience (N=21) (Figure 3):

- Over 95% of the VC participants agreed or strongly agreed that the session was well organized.
- 90% of the VC participants agreed or strongly agreed that the sessions were educational and a model of effective online instruction.
- Over 85% of the VC participants agreed or strongly agreed that the overall experience was positive.

![Figure 3: Survey question to participants asking their perception of the Virtual Classroom: Learning through Video Analysis session.](image)

The following feedback was about the application of the VC sessions (N=21):

- Over 85% stated that the VC helped them use the DESI Framework (content storyline) to improve existing lessons.
- About 76% stated that the session helped them from a fair amount to a great extent develop or revise science lessons in their own classroom.
The following responses are the number of participants that rated the extent to which the VC helped them learn about the strategies for creating a coherent storyline into their lessons to a great extent and a fair amount. (N=21)

- Focus on one main learning goal: 62% great extent; 24% a fair amount
- Link the learning goal to ideas learned in previous lessons: 57% great extent; 33% a fair amount
- Set the purpose using focus question or goal statement: 62% great extent, 29% a fair amount
- Refer back to the goal statement or focus question throughout the lesson: 62% a great extent; 29% a fair amount
- Select activities and content representations that are matched to the learning goal: 48% a great extent, 38% a fair amount

Open-ended comments regarding effectiveness, impact, and application revealed that participants appreciated the interaction and exchange of ideas across different places and with science experts, as this was important for reflecting on their own practice; that the use of technology and the “chunking” of videos enabled real-time comments and immediate feedback grounded in the analytic tasks; and that the project and its tools had served as an impetus to improving their own teaching.

Open-ended comments regarding impact:
What impact do you believe the Virtual Classroom will have on your science teaching?

- “Helpful. Good ideas that I plan to incorporate. I believe it will help sharpen my focus on goal, content, and connections.”
- “It is always helpful to see the science behind science instruction and this virtual classroom helped illustrate this well”
- “I hope to incorporate these ideas into ALL my lessons (not just nano).”
- “The virtual classroom provided a venue on how to walk the students through the process of learning a concept.”
- “I think exposure to this type of "reminder" helps us focus on effective learning strategies throughout the school year.”
- “It gave me ideas that I could immediately use in my classroom.”

Open-ended comments regarding use:
What was most useful about the Virtual Classroom experience?

- **Convenience** of participation at home without driving to a specific location
- Being able to **communicate** with people from other school districts
- It is the interaction and exchange of ideas between and among teachers not physically together in one place.
- **Visual and audio interaction.** Immediate feedback.
- I liked that it was a **small group** setting.
- Being able to ask questions and get immediate feedback.
4. CONCLUSIONS AND FUTURE RESEARCH

Our preliminary data demonstrate there is great potential to use VC-LVA as a learning platform for expanding disciplinary and pedagogical content knowledge of educators and creating opportunities for virtual peer communities to participate in meaningful learning. Bringing together teachers virtually into small peer communities is a realistic and convenient approach that supports discourse focused on videos of authentic classroom instruction. The specific emerging science content addressed in this Virtual Classroom: Learning through Video Analysis program focuses on nanoscience and technology integrated with content storyline pedagogical strategies. There is promise, however, for this model to be applied to any discipline and pedagogy. Engaging in a facilitated review process of authentic classroom video with educators will be needed to support both current and future educators. VC-LVA has the potential to provide online, synchronous professional development to educators that are geographically distant, but have similar focus and interest, in a meaningful and engaging way using authentic classroom video in a platform that allows for multiple ways of communication.

This approach is practical and meaningful, aligns with the Standards for Professional Learning from Learning Forward [1], engages educators in developing understanding and skills that inform their practice, and helps ensure that they and their students are inspired, engaged and motivated through relevant, contextually based and personally meaningful experiences that prepare them for lifelong learning in a technologically progressing society. The VC-VLA platform reflects the best use of academic standards, research, and innovative approaches to learning.

While VC-LVA has shown promise in this professional development project, more research should be done to determine how a more intense treatment of learning with this platform might improve practice in a sustained manner over a longer period of time. Additional studies could be conducted to determine the extent to which teachers would be comfortable coding lessons that they developed with communities of practice in different geographic regions. Other research areas could include using VC-LVA and measuring growth in areas that include different pedagogical content and subject matter.

REFERENCES