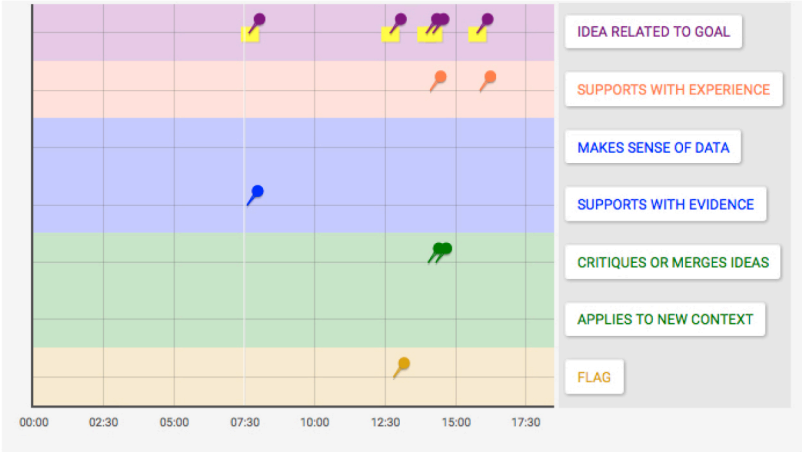

VideoReView Teacher's Guide

Noticing Students' Ideas in Science

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VideoReView Teacher's Guide

Noticing Students' Ideas in Science

VideoReView is the collaborative work of TERC, intuVision, Boston College, and Boston area teachers and supported by funding from the National Science Foundation, grant #1415898.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

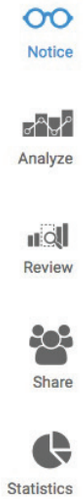
Contents

1 The Vision

Noticing Students' Ideas and Reasoning

The artistry of teaching begins with noticing what students think and the reasoning behind their ideas, and only then, deciding what to do to help them move their understanding forward. The classroom is a busy place; this kind of on-the-spot attention to students' ideas, how their ideas are evolving, and responding in ways that foster deeper thinking is always challenging. This, however, is changing.

With the help of video technology, you now can easily capture and study the ideas and reasoning your students bring to their learning. Developing the art of teaching becomes an ongoing process in which video from your own classroom can ground your professional learning and anchor discussion with colleagues about student learning and implications for teaching.



What is VideoReView?

VideoReView is a tool and associated professional development (Tool+PD) to support better science learning. The Tool+PD makes it practical for you to capture and work with video from your classroom. It is designed to boost your ability to notice and analyze students' science ideas and reasoning, and then to take actions that will help students deepen their science understanding.

The VRV tool consists of a camera, a secure device for collecting and storing classroom video, and software for viewing, organizing, and sharing video clips. The PD, set in the context of science learning, is based on a Video Club model in which teachers use video segments from their classroom as a basis for discussing science learning with colleagues.

The Power of Video

Video provides evidence of what students do and say in the science classroom. Video lets you examine your students' thinking in detail. You can select video segments to share and discuss with colleagues, and benefit from their multiple perspectives. When professional learning is situated in your day-to-day practice, it has immediate relevance and is likely to have lasting impact on your students' learning.

How VideoReView Works

VideoReView builds on what you already do in the classroom and enables you to do it better. The VRV Tool + PD provide you with timely, ongoing feedback about your students' learning and a genuine artifact (video) to anchor reflection in your own practice and professional discussion with colleagues. What you do everyday in your classroom becomes inseparable from professional learning.

Plan

Plan a science discussion as part of students' science experience.

Enact

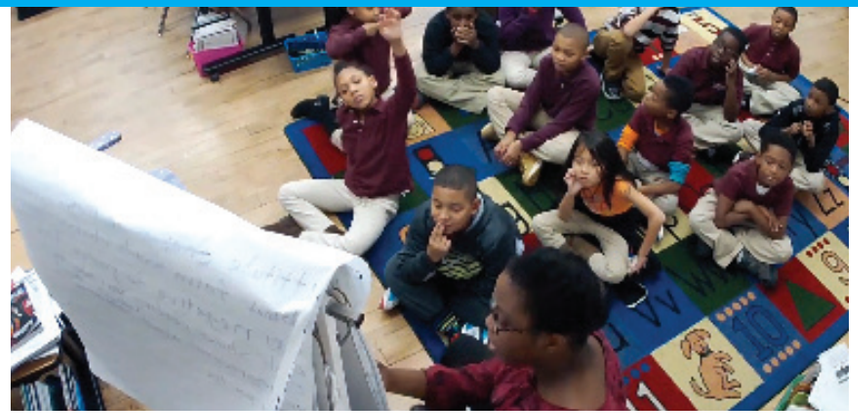
Follow the learning activity with a facilitated class discussion in which students make meaning of their science investigations. Videotape this discussion.

Study

Use the VRV software and Science Lens to search for evidence of students' ideas and reasoning. Identify a rich event in the video for deeper study with colleagues.

Meet

Get together with colleagues for a Video Club meeting. Share and discuss your classroom video cases.



2

In the Science Classroom

Notice

Analyze

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What Should Students Be Learning?

The vision of the National Research Council's Science Framework encompasses both the knowledge and practices of science. Today's science learning empowers students to use the practices of science to develop evidence-based understanding of important ideas of science, and to be prepared to pursue and answer questions that society will encounter in the future.

What Does It Look Like?

When students use science practices to build science knowledge they investigate a question. Through discussion they become familiar with their own and others' existing ideas about the question. Investigations and other activities provide them with evidence and scientific principles they use to rethink their ideas. Discussion with peers is an essential part of their learning as it provides opportunity to make meaning of their explorations and investigations together, and to test their understanding by applying new learning in other contexts. This ASK-INVESTIGATE-MAKE MEANING-APPLY structure is elaborated in Table 1. Each part of the lesson structure is designed to support specific student actions. VideoReView comes into play during ASK, MAKE MEANING, AND APPLY as students discuss their ideas and reasoning.

Why Focus on Discussion?

In VideoReView, classroom science discussions are captured on video. The video focuses on discussions because as they talk, students reveal their ideas and the reasoning behind those ideas. They come to recognize that their peers may have different ideas.

A close look at a meaning-making discussion also reveals students' ability to use the practices of science. For example, do students habitually support claims or ideas with evidence? Can they use evidence to look critically at a claim or an explanation? Do they craft explanations based on evidence and well-established scientific principles?

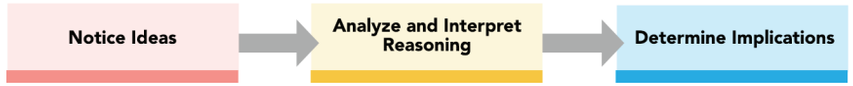
Table 1 Capture Science Thinking with VideoReView

Ask	Investigate	Make Meaning	Apply
Lesson Structure			
The science lesson is anchored in an investigation question related to the learning goal.	Classroom activities provide opportunity for students to collect data they use as evidence to answer the question.	All-class discussions provide a forum for analysis and debate with peers.	Discussions provide an opportunity to apply the learning to new contexts.
Student Actions			
Students share ideas and reasoning about the investigation question.	Students actively explore, observe, and measure to gather evidence to answer the investigation question.	Students critique evidence, merge ideas, and seek consensus on an answer to the question. Students rethink their initial ideas.	Students use their new learning in novel contexts.
Using VRV			
Capture elicitation discussions to take stock of students' initial ideas and reasoning. You'll gain insight into the range of ideas students bring to their learning.		Capture meaning-making discussions for a rich source of evidence of how students' ideas and reasoning are evolving as well as their analysis and reasoning skills.	Capture students' responses to prompts asking them to apply new learning in novel contexts to gain insight into the robustness of their ideas.

How Will VideoReView Help?

VideoReView helps you: 1) slow down and attune to students' ideas and reasoning; 2) focus on specific interchanges among students and between you and your students; 3) notice how students react and respond to others' ideas; and 4) understand and keep track of how ideas evolve.

The VideoReView Tool and associated Video Club meetings help you to notice more, to analyze and interpret what you see, and to consider implications for helping students to deepen their learning.



What is the Science Lens?

The VideoReView software provides a metaphorical lens to help you focus sharply on students' science learning during a discussion. It helps you to keep the focus on two questions:

- What are students' ideas?
- What is the reasoning behind their ideas?

Notice Ideas

Shares a new **idea** (claim, prediction, or explanation) related to the learning goal

Analyze Reasoning

Supports idea with **everyday experience** or **imagined situations**
Makes sense of **data** (notices patterns and anomalies, interprets data)
Supports an idea with **evidence** and/or **scientific ideas** from investigations
Critiques or **merges** own and others' ideas
Applies relevant scientific ideas to new contexts

The order of the lens tags is not significant.

The lens has two key areas of focus: NOTICE IDEAS (pink) and ANALYZE REASONING (orange, blue, and green). Notice Ideas focuses on the question: What are students' ideas related to the learning goal?

When a student expresses a new idea, you can "tag it" or add a sticky note that describes specifics about the idea. These notes help you to keep track of the range of ideas students bring to their learning and gain insight into how their ideas develop.

In Analyze Reasoning, attention shifts to the second question: What is the reasoning behind students' ideas? The Analyze view provides five tags that describe the kinds of reasoning students might use. You can add these tags to relevant points in the video along with a sticky note. The tags reflect the practices of science and serve as indicators that students' ideas and reasoning likely are becoming stronger.

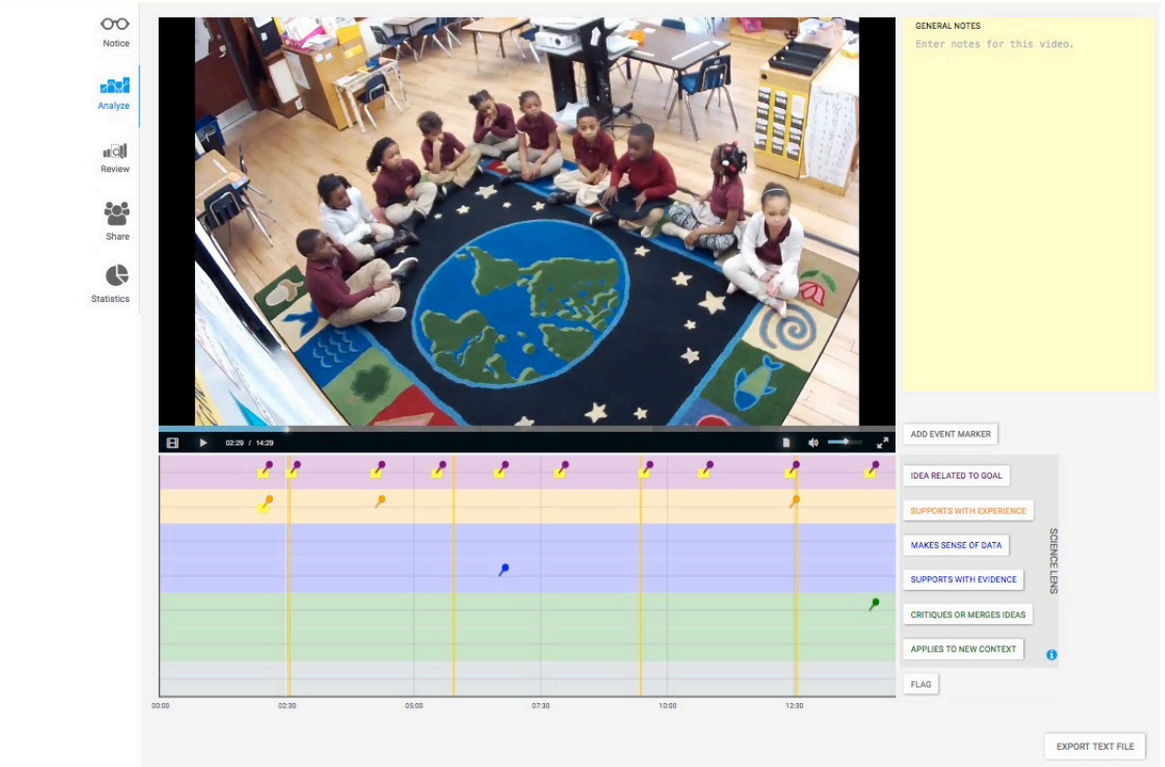
Using the Science Lens is a non-judgmental, information-gathering process. The Science Lens helps you to focus on a small set of issues, and lessens the demands of reviewing video. The Science Lens tags reflect actions that may occur at any time during discussion.

The lens and tags help you to:

- notice student ideas.
- know what sense students are making of their investigation data.
- keep track of students' evidence-based reasoning.
- take stock of students' initial ideas, know if students become critical of their initial ideas, or bring their prior experiences and investigation experiences together to create an explanation.
- know if students are building ideas together or changing their ideas based on their investigation experience and the ideas of others.
- determine if students are able to apply an idea to other contexts.

How can you use the lens with colleagues?

Effective use of the lens will depend on you and your colleagues having a common understanding of the tags, and then using the tags consistently to mark events in classroom video. Tagging is a skill. You hone this skill when you and your colleagues view and tag the same video and discuss reasons for a particular tag when there is discrepancy. Even with practice, there will continue to be discrepancies that can only be resolved through discussion.



3

Plan, Enact, and Study

The VideoReView Program enhances what you do every day in your classroom. It includes a 4-part sequence in which you first plan a science experience and its associated class discussion, enact and videotape the discussion, study your students' ideas and reasoning, and meet with colleagues to share and discuss cases. This section provides guidelines for the first three parts of the sequence: PLAN, ENACT, and STUDY. MEET is explained in detail in Section 4.

Notice

Analyze

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Plan

Your experience with VideoReView will be more successful if you have a solid plan for the discussion associated with the learning experience What are your learning goals? What question will students investigate and discuss? What ideas might they have?

Try diagramming a discussion plan. First identify the learning goal and the discussion question. Then step back and anticipate what students might think related to the goal. This strategy of anticipating students' ideas will help you to listen for the ideas they put forward. Plan to keep the discussion to between 10 and 20 minutes.

Discussion Planner : A Sample Plan

Topic

Water Displacement

Learning Goals

- When an object is submerged in water, it changes the water level.
- It is volume, not weight that determines how much water is moved aside (or displaced).
- Two objects (e.g., water and a rock) cannot occupy the same space at the same time.

Discussion Question

What happens to the water level when an object is placed in water? Why?

Anticipated Student Ideas

The water level will stay the same if a very small object is added to the water.

The water level goes up because the weight pushes on the water.

If the weight of the object is heavy, the water level will rise more.

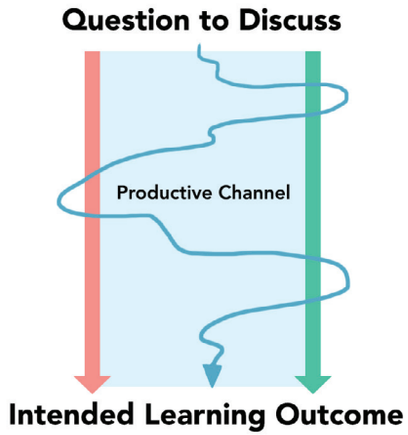
If you slip an object into water very slowly, the water level won't go up.

The water level goes up because the object pushes the water out of the way and up.

Enact

Discussions that Lead to Learning. Students' ideas come together and deepen as they express and rethink their ideas and reasoning.

Imagine a class discussion as a pathway. This pathway begins with an organizing question and moves toward the anticipated learning outcome. In the center of the path we envision a "productive channel" in which students' ideas build toward the intended understanding. However, discussions seldom play out this way! It's to be expected that ideas sometimes veer off path. Listen to all student ideas as they are likely important building blocks in their learning. When appropriate, guide the discussion back onto the path by simply restating the question.



Eight Key Ingredients of Effective Discussions

- Establish norms for discussions with students.
- Plan to keep the discussion focused and short (10-20 minutes).
- Use the learning goals to determine the discussion question.
- Refer to artifacts from the investigation, e.g., materials, notebook entries.
- Focus on ideas. Elicit ideas with questions like: What do you think?
- Encourage students to consider the evidence and reasoning. Ask, "What's the evidence?" "What makes you think that?"
- Return to the discussion question occasionally to maintain the focus.
- Learn to use "moves" that facilitate productive discussions. See http://inquiryproject.terc.edu/shared/pd/Goals_and_Moves.pdf
  Also see "How to Uncover Students' Ideas" in the Reference section of this Guide.

Why Videotape the Science Discussion? As they talk, you'll hear evidence of the ideas students bring to their learning and how their ideas evolve.

Sit with your back to the camera to capture your students' faces and voices. A discussion circle in which students face each other is the most productive configuration for class discussions. Students more readily attend to others' ideas when they can see each other's faces and aren't speaking to anyone's back. Prior to launching the discussion check to be sure:

- only students for whom you have permissions are in the video frame.
- the camera and mini-PC are turned on and linked.
- the camera is recording.

Study

What can I learn about my students' understanding related to the goals? Use the VideoReView software to study your video and answer this question. The three steps for study are: 1) Notice students' ideas, 2) Analyze students' reasoning, and 3) Review your findings. These steps align with Notice, Analyze, and Review in the software.

Notice

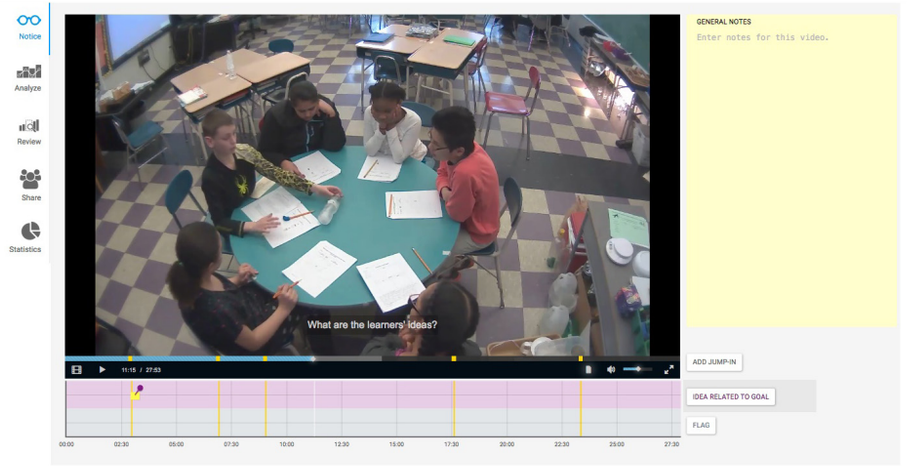
- Study the automated jump-ins. These are promising learning points identified by the software. They provide a good starting point for reviewing video.
- If you like, add new jump-ins and delete existing ones.
- Search for and tag learners' ideas related to the learning goal.
- Identify and highlight one event in the video for deeper study.

Analyze

- Focus on the event you selected for deeper study.
- Replay the event. Use the Science Lens tags to annotate students' reasoning and the science practices they use in their reasoning.
- As you focus on the event, think about the learning goals, the potential difficulties students may have in attaining these goals, the ideas they might bring to their learning. Then, step back and consider how this experience is contributing to their understanding. Is there evidence that their ideas are moving forward?

Review

- Select the Review Canvas to prepare a case.
- Select one video event that raised your curiosity about students' ideas.
- Craft a question to discuss with your colleagues that focuses on the selected event and students' ideas.
- Add your question and the video segment to the Review Canvas.
- Add the investigation question and learning goal(s).
- Plan to share your case with colleagues at the next Video Club meeting.



4

The Video Club

What better source of learning than video from your own classroom? Through video, you can re-enter your classroom without the responsibilities of teaching. You can observe, ask questions and reflect on your students' learning.

Who better to learn with than your colleagues? You share much understanding with colleagues. You understand the culture and expectations of the school; you may teach the same curriculum; you may know the same students and their families.

How Does a Video Club Work?

A Video Club is similar to a teacher study group or professional learning community. You and your colleagues meet and engage in inquiry about student thinking. Video from your classroom anchors your discussion.

Notice

Analyze

Review

Share

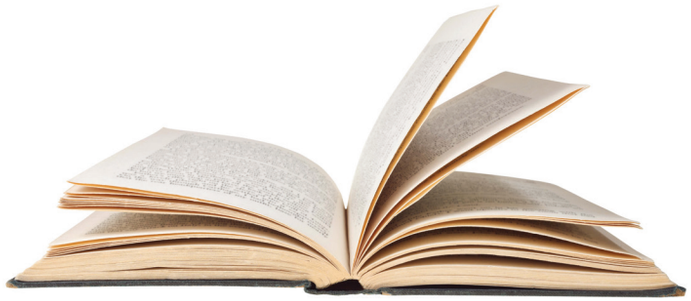
Statistics

It's Like a Book Club!

Members of a book club typically read a book on their own. When the book group meets, a person may raise questions or select passages for the group to discuss. In a Video Club model, a teacher first analyzes video from her own classroom independently. She then selects a clip and crafts a question about students' ideas to tackle with colleagues.

Goals of the Club

- Together analyze students' ideas and reasoning related to the teacher's question for the colleagues.
- Use students' ideas and reasoning as a basis for making instructional decisions.



Prepare to Meet with Colleagues

Prior to meeting, identify one person to facilitate. This responsibility can shift from meeting to meeting or remain the same for all meetings. You and your group decide. If you are the designated facilitator refer to the guidelines/strategies provided to support productive Video Club meetings found in Section 5: Resources.

Establish a time to meet and agree that everyone will arrive five minutes prior to the start time. Starting and ending on time contributes to more productive meetings.

Plan to hold your meeting in a quiet place where there won't be interruptions and where you can view video together.

Likely, there will be time for only two cases. Coming prepared with a case even when you are not sharing will help you make meaningful contributions to the discussion. It will also give you an opportunity to reflect on what your students understand or are confused about.

Build a Supportive Community

Start your Video Club by establishing norms for working comfortably and respectfully with classroom video. Keep in mind that everyone is probably a bit nervous about sharing video from their classroom. Take time to hear everyone's concerns so that all will be comfortable. Keep in mind that you always decide what to share and what not to share.

Share a Case

The purpose of the case is to study students' ideas and how their ideas develop. The case should take about 20 minutes. Allow 5-6 minutes to introduce the case and 10-15 minutes for discussion. The diagram on page 29 illustrates the case process.

Set the Context (5 minutes):
Introduce the video segment with an organizing question or dilemma related to students' science ideas.

Sample Organizing Questions

- Do you see evidence of students learning from each other?
- How does student understanding evolve during the discussion?
- What do students think about how the brain, spine, and nerves work together?

Ask Clarifying Questions (3 minutes):
Restate the question or dilemma. Invite clarifying questions from your colleagues.

Discuss Students' Ideas and Reasoning (2-5 minutes):
Listen quietly for a couple minutes while your colleagues discuss what they observed that is pertinent to your question. Then, join in. Ground ideas and questions with evidence from the video segment shared. If the discussion begins to diverge, restate the question.

Consider Implications (1-5 minutes):
Respond to your colleagues' feedback. Based on discussion, what insights and questions emerge? What are the implications of the discussion for your teaching?

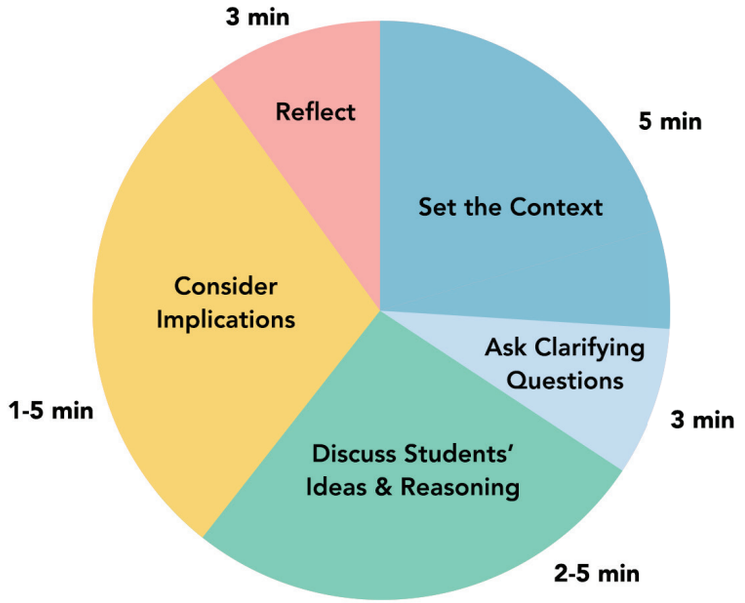
Reflect (3 minutes):
Each person writes a brief reflection to capture insights and implications from the case. You and your colleagues may choose to share reflections.

Respond to Colleagues

- Keep in mind that the purpose of the Video Club discussion is to work together to understand students' ideas and their development.
- Focus on the organizing question of the case.
- Pose questions and ask for clarification.
- Provide feedback based on evidence from the video. Share observations.

Use Feedback to Inform Teaching

- Based on discussion with your colleagues, what insights and questions emerge?
- What are the implications of the discussion for your teaching?



What Do I Do Once I Know What Students Think?

With insight into your students' ideas and reasoning, you are better positioned to support their understanding. Some of your actions to move learning forward will happen on-the-spot in the moment of teaching, while others will be folded into your plans for the next day. Here are a few actions you might take. Other actions will come naturally.

Examples of on-the-spot actions

- Ask students to turn and talk with a peer.
- Ask students to weigh two conflicting ideas that they put forward.
- Ask students to reason with data and evidence from their investigation.
- Interject a bit of information or clarification if it will help overcome a roadblock.

Examples of future actions

- Refer to students' current ideas when you introduce the next discussion.
- Revisit the same question or idea in the context of a new investigation.
- Extend the range of evidence students have to work with.
- Encourage students to generalize from one context to another, e.g., "Would the same thing happen in this case?"

5 Resources

VideoReView FAQ

Where is classroom video stored? Your video data is stored on a secure server in your classroom and at intuVision during the research study only. Your video collection is password protected for your students' and your privacy. Do not share your password with anyone.

When do others see my videos? During Video Club meetings, you'll share video clips with your colleagues. These clips will be selected by you and accessed from the secure server. You have full control of what is shared during Video Club meetings.

Who else can see my video? Researchers can during the research study. Going forward, no one. The primary purpose of VideoReView is to provide you with information about your students' learning. You decide when and with whom to share video. For example, you'll certainly share video segments with your colleagues during Video Club meetings; you might share video segments with your students to discuss their learning, or with other professionals within and beyond the school for professional development purposes.

When shouldn't I share video? Always consider privacy issues before sharing video. For example, sharing video with parents may not be a good idea as the video clip will include other children. When sharing video, we encourage you to "catch" your students at their best.

Do I need parental and student permission to videotape? Check your school policy before videotaping students. Use the permission process required by the school. This year is different. During the research study, the researchers will also have access to your video and are responsible for the permission process. Video from your classroom will be used to study how video contributes to learning. Next year and going forward, only you will have access to the video you capture.

What happens if a student doesn't want to be videotaped? This happens. Provide alternative plans for these students to ensure that they engage in all learning experiences. For example, you might re-craft the videotaped discussion as an independent activity for the non-participating student.

What happens if a student who doesn't have permission is captured in a video by mistake? Simply delete the video file. This ensures that you are in compliance with Human Subjects requirements.

Can my administrator see the video? That's up to you. We believe teachers will use video more freely if they decide what to share and with whom.

Will VideoReView take too much time? The time you spend is flexible. You may spend several minutes or an hour reviewing a video. For example, if you are preparing for a Video Club meeting, you'll spend more time or you may become curious about a particular video and spend more time. On a day-to-day basis, you may just do a quick "look back" at the end of the school day or while planning the next lesson.

What if I have a technical question about the tool or software? Immediately call or email intuVision -- (781) 497-1015, vrvsupport@intuvisiontech.com

Which browser should I use to access VRV? We currently suggest the most recent update of Chrome. Upcoming versions of VRV will have broader support.

Can I leave my camera on throughout the day? Yes, leave your camera plugged in, these cameras are NOT designed to be powered on and off frequently. Doing so may cause the camera hardware to fail. Also this helps to avoid the need to reposition each time as the camera view may shift by unplugging and plugging. As each camera is connected only to its associated ZBOX, there is no fear of unintentional recordings.

What should be included in the camera view? The camera view should be tightly zoomed around the discussion of interest, allowing for all of the students, including possible raised hands, to be in the scene.

Is proximity to the camera important? Yes, the discussion should be as close as possible to the camera to allow for the best sound and video quality.

Should I do a test recording test each time I record a video? If the mini-PC or camera has been unplugged, turned off, or moved, testing is recommended. If nothing in the system has changed, additional testing is not needed.

How long will it take to process and upload my video to the intuVision VRV server? This depends on the recorded discussion length (hence the size of the video file) and the school network upload speed. Uploading will happen fairly quickly. Processing may take an hour or two.

Where can I access my video? Could I access it from my mobile phone? Once the video is uploaded onto the server, you can access it on your computer, tablet, or phone from school or elsewhere.

Must I use the automatically generated jump-in points? We encourage you to review the jump-ins, but then delete or add your own as desired.

Facilitator Guidelines

1. Convene the meeting on time.
2. Be sure everyone contributes.
3. Keep the conversation focused on the video-case question.
4. Focus the conversation on students' ideas and reasoning.
5. Press colleagues to explain/elaborate their comments.
6. Consider different points of view.
5. Encourage everyone to use evidence from the video.
6. Keep track of time (15-20 min. for each case).
7. Allow time to consider "takeaways."

How to Uncover Students' Ideas

Here are a few strategies to help you uncover students' ideas and the reasoning behind them during discussions.

1. Open the discussion with a question

Whole class discussions provide a context for sharing ideas. Launch the discussion with a question focused on the goal of the lesson. Make sure the question is "open" (not a yes or no or right answer question) and invites everyone's ideas.

Listen to students' initial ideas - simply listen closely to all ideas. Be non-judgmental. Make sure that you understand each idea. Students' initial ideas often are based on prior experience and are the starting points for building more scientific ideas. During this time, students also hear each other's ideas. Both you and your students will become familiar with the range of ideas within the classroom community.

2. Ask: What do you think? Why?

To elicit ideas ask questions such as: What do you think? Why? Why do you think that? What makes you think that? Could you say more about that? What evidence/scientific ideas support your reasoning?

3. Turn and talk

Provide opportunity for students to become familiar with their own ideas before they share them with the whole class. This can be done by asking students to "turn and talk" with one student or in small groups. This strategy takes a minute or less and has big pay offs. "Turn and talk" can also be used in the middle of a discussion if students seem stuck.

4. Write or draw ideas

Provide time for students to write or draw in response to the central question. This gives them opportunity to think and commit to an idea. This provides evidence of their thinking that they can return to later. Ideas become stronger when students see evidence that their ideas have changed. A written record provides this evidence. Following a discussion this writing prompt can be helpful:

I used to think this _____ because_____.
Now, I think this _____ because _____.

5. Apply idea to new context

Are students able to apply their understanding to new contexts? Put forward a new situation for students to consider. See if they draw on their new understanding.

The Inside Story

Why did we develop VideoReView System? Behind this effort is a theory of change we'd like to share with you.

We believe that if teachers are able to easily collect and study video from their classroom discussions and then share and discuss self-selected segments from these videos with colleagues, their students' ideas and reasoning will become more visible and more often the object of study. Teachers could more readily craft their instruction in response to students' ideas. We predict that students' participation in science discourse will become more productive as their ideas become more visible. They, in turn, will listen to and build on each other's ideas more. These changes in classroom interactions will lead to deeper student understanding.