Interactive STEM

RESEARCH + PRACTICE TOOL

Interactive Technologies in STEM Teaching and Learning

Supporting Equity Through Co-Investigation: Sharing Student Videos

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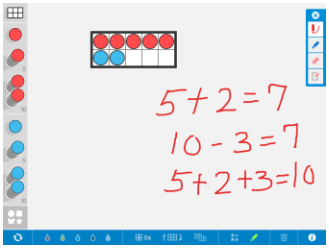
Teachers, principals, researchers, and faculty alike watched intently as students wrote numbers, made calculations, and moved circle markers on ten frames



Watching videos of students solving math problems was a key part of partnership meetings during a research and practice collaboration in Auburn, Maine. The partners—K-2 teachers, technology integrators, school and district administrators, university faculty, and researchers—gathered to study how to best integrate mobile technologies in mathematics lessons to improve learning for early elementary students. They designed strategies to test in the classroom, collected and co-analyzed student work including student-made videos, and shared and discussed their learning. The rationale, process, and tips for using student videos during co-investigation meetings is described below.

A Closer Look

The R+P Collaboratory and Auburn partnership engaged in collaborative investigation of whether early grades students' learning of and engagement in mathematics improves if they record and review their thinking about math problems using apps on mobile devices. The partners used an iterative collaborative investigation process to test this conjecture by defining and refining strategies to implement in classrooms. Between monthly meetings, teachers integrated refinements into lessons observed by researchers and university faculty. At the meetings the partners formed small grade-based mixed-role groups to discuss what happened during the lessons, look at evidence in collected student work, and plan the next cycle of classroom implementation.

The small groups followed a protocol to share and discuss student work. The work was primarily self-recorded student videos made with screencasting apps (such as Explain Everything™ and ShowMe™) on mobile devices. Following the protocol, each teacher in turn described the context of their lesson's math problem (e.g., the lesson goal), important information about their student (for example, how the student had performed on math problems in the past), and showed the video the student created as she/he solved the math problem.

It is important to note that the videos were not taken by an observer. Students used a screencasting app, sometimes in combination with other apps, to record video of themselves while

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they narrated their steps and thinking while solving the math problem. The students were also expected to watch their recordings and discuss them with classmates to practice constructing viable arguments and critiquing the reasoning of others. Teachers reported that many students were motivated by listening to their own videos, and teachers often heard students self-correcting after listening to their own explanations.

The partners engaged with student videos at each monthly meeting. A student's narration of how she approached the math problem provided information that wasn't obvious from just her final answer or her work steps on paper. In this way, teachers had the opportunity to "see inside the minds of their students," which led the partners to new insights about the phenomena of students learning mathematics. The video recordings were also engaging, in part, because they related to the partners' interests and identity, that is, as people invested in education. In addition, the videos invited inquiry and discussion at a variety of levels: about the mathematics problem; about the student's approach to solving the problem; about the use of technology in mathematics lessons; and about instructional approaches. These discussions helped the partners develop their content knowledge, pedagogical content knowledge, and technological pedagogical content knowledge in a potentially less threatening way than dissecting a teacher's practice in a classroom video.

The student video data fueled the co-investigation of the conjecture. The partners looked for evidence that the technology was enabling students' learning of and engagement in mathematics. The focus on student thinking, discourse, and approaches to solving mathematics problems supported collaboration among partners with different roles and invited multiple perspectives, including about how to interpret the evidence in the videos and about possible implications for refining the strategy to improve student learning. In this way, there were parallels between the characteristics of a problem solving approach with rich math tasks and analyzing the student videos.

Teachers were able to build on the ideas generated during small group sharing when completing their Strategy Planning Form. The form helped teachers plan their next implementation lesson. Over time, the iterative cycles of development and study helped teachers—including previously reticent teachers—notice new aspects of student behavior; make connections between student performance, curriculum, and instruction; feel more skillful when integrating technology in their lessons; and be more capable of helping their students develop their knowledge of mathematics and practices of discourse and critique.

Rich Math Tasks

- Are accessible to full range of sharing group participants
- Are set in classroom's within the same district and at same grade level, i.e., contexts that are familiar to participants
- Allow for learners to pose their own problems
- Allow for different methods and responses
- Offer opportunities to identify efficient solutions
- Have the potential to broaden students' skills and/or deepen and broaden mathematical content knowledge
- Encourage creativity in applying knowledge
- Have the potential to reveal patterns or lead to generalizations or unexpected results
- Have the potential to reveal underlying principles or make connections between areas of mathematics
- Encourage collaboration and discussion
- Promote critical thinking and allow learners to develop confidence and independence

Accessed at https://ccssmresources.wikispaces.com/file/detail/Rich%20Tasks%20complete%20packet.pdf

Strategy Planning Tool & Strategy Sharing Protocol

The Sharing Protocol provides a structure for teachers to present information about the strategy they implemented (including the lesson goals and pedagogical context in which the students used the apps) and to report how students responded to various aspects of the lesson. The protocol aims to help teachers consider the evidence about how interactive technologies can be used to support learning goals and to help promote mathematical thinking and discourse. The Strategy Sharing Protocol is a companion to the Strategy Planning Tool, which may be used to plan how to implement a strategy in the classroom. The questions in the planning form prompt teachers to think about the lesson goals and pedagogical context in which they will use these apps and to hypothesize how students will respond to various aspects of the planned activity. The tool helps teachers think systematically about how interactive technologies can be used to support learning goals and to help promote a reflective and investigative mindset during instruction.

Tips for Sharing Student Videos

- Provide time for everyone (e.g., teachers, administrators, and researchers) to explore the apps together so that they are familiar and comfortable with the features and functionality.
- Share and discuss best practices and routines for managing the technology in the classroom, including helping the students use the mobile devices and store their recordings.
- Allow the students to explore the technology prior to using it for recording their mathematics problem solving steps.
- Provide open math problems that allow the students to consider multiple solutions.
- Provide multiple tools (e.g., manipulatives and math apps) for students to use to solve the math problem.
- Provide students with tools (e.g., sentence starters and guides) and routines to help them clearly explain their thinking.
- Provide opportunities for students to record their thinking and play back the video, as well as time to share and discuss their videos with other students.
- Save student videos and store them online to access in the future.
- Encourage teachers, or teacher and researcher teams, to watch student videos prior to the group meeting and choose which video(s) to share with their small group.
- **Use student videos to focus those discussions on collectively and actively figuring out what improves student learning, using the videos as evidence.**
- Divide into small groups that include a mix of teachers, researchers, faculty, and other partners.
- Design small groups to have commonalities (e.g., focused on the same grade level) as well as diversity (e.g., different roles).
- Use a protocol to ensure that each small group member has a role, time, and a guide to support their contributions during collaborative interactions.

Resources

Strategy Planning Form
Pam Buffington, Josephine Louie, Catherine McCulloch
http://interactivestem.org/wp-content/uploads/2015/06/Interactive-STEM-Tool-Strategy-Planning-Form.pdf

Strategy Sharing Protocol
Catherine McCulloch, Pamela Buffington
http://interactivestem.org/wp-content/uploads/2015/07/Interactive-STEM-Tool-Strategy-Sharing-Protocol.pdf

Supporting Mathematical Discourse in the Early Grades
Jennifer Stiles
http://interactivestem.org/wp-content/uploads/2016/07/Supporting-Mathematical-Discourse-in-the-Early-Grades.pdf

Mobile Technology and Mathematics Learning in the Early Grades
Ashley Lewis Presser and Amy Busey
http://interactivestem.org/wp-content/uploads/2016/07/Mobile-Technology-and-Math-Learning-in-the-Early-Grades.pdf

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